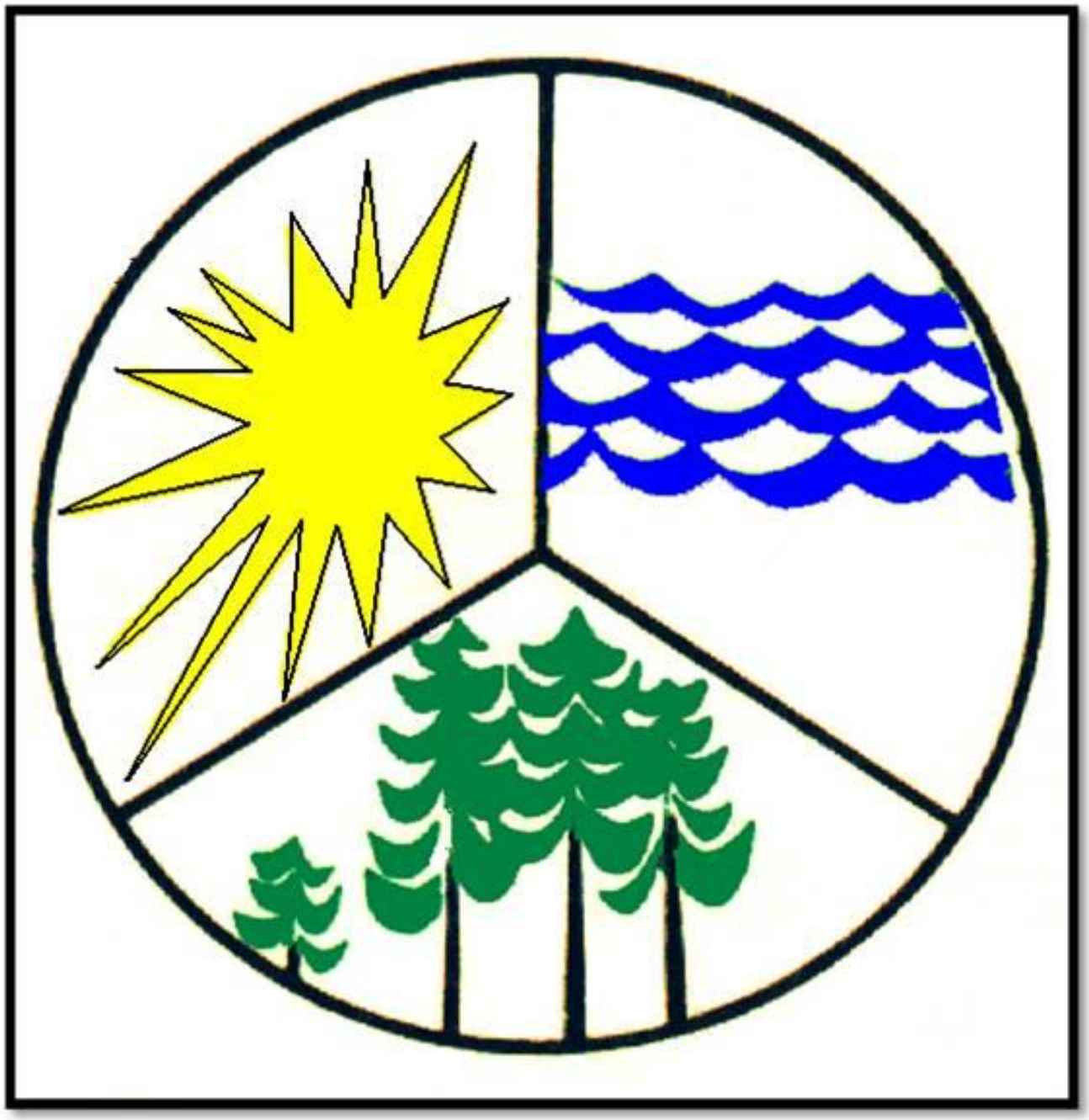
Waccamaw Region Section 208 Water Quality Management Plan

For the Waccamaw Region in South Carolina including Horry, Georgetown, and Williamsburg Counties.

Prepared by the Waccamaw Regional Council of Governments-Adopted by Board of Directors on October 10, 2011.



RESOLUTION
ADOPTION OF THE 2011 WACCAMAW REGION SECTION 208 WATER QUALITY MANAGEMENT PLAN FOR THE WACCAMAW REGIONAL COUNCIL OF GOVERNMENTS

WHEREAS, The United States Congress enacted in 1972 the federal Clean Water Act; and

WHEREAS, Section 208 of the federal Clean Water Act includes requirements for each state to develop regional water quality management plans; and

WHEREAS, The State of South Carolina designated the Council of Governments throughout the state as the responsible entity for developing regional water quality management plans; and

WHEREAS, The Waccamaw Regional Council of Governments has previously adopted and updated Section 208 Water Quality Management Plan for the Waccamaw region in 1978, 1981, 1986, and 1998; and

WHEREAS, The Waccamaw Regional Council of Governments was provided the opportunity by the South Carolina Department of Health and Environmental Control to update the Waccamaw Region Section 208 Water Quality Management Plan via an American Recovery and Reinvestment Act grant; and

WHEREAS, The Waccamaw Regional Council of Governments has completed such a plan update:

NOW THEREFORE, THE WACCAMAW REGIONAL COUNCIL OF GOVERNMENTS, BY RESOLUTION, HEREBY ADOPTS A DOCUMENT TO BE KNOWN AND CITED AS "2011 WACCAMAW REGION SECTION 208 WATER QUALITY MANAGEMENT PLAN" INCLUDING ALL REFERENCED PLAN MAPS AND EXHIBITS, THIS 10TH DAY OF OCTOBER, 2011.

James Frazier, Chairman
Waccamaw Regional Council of Governments Board of Directors

Waccamaw Region Section 208 Water Quality Management Plan

Table of Contents

Waccamaw Region Section 208 Water Quality Management Plan

Table of Contents

Section Title **Page Number**

Chapter Three: Watershed Assessments

Waccamaw Region Section 208 Water Quality Management Plan

Table of Contents

Waccamaw Region Section 208 Water Quality Management Plan

Table of Contents

Waccamaw Region Section 208 Water Quality Management Plan

Table of Contents

Waccamaw Region Section 208 Water Quality Management Plan Acronyms and Abbreviations

Below is a compilation of acronyms and abbreviations utilized throughout the text of the Waccamaw Region Section 208 Water Quality Management Plan and the corresponding appendix.

AIWW- *Atlantic Intracoastal Waterway*

AL- *Aquatic Life*

ARRA- *American Recovery and Reinvestment Act*

BMP- *Best Management Practice*

BOD- *Biochemical Oxygen Demand*

CAFO- *Concentrated Animal Feeding Operation*

CCD- *Census County Division*

CDP- *Census Designated Places*

CEPSCI- *Certified Erosion Prevention and Sediment Control Inspector*

CFU- *Colony Forming Unit*

CMOM- *Capacity, Management, Operations, and Maintenance*

COG- *Council of Governments*

CSPR- *Certified Stormwater Plan Reviewer Program*

CWSEC- *Coastal Waccamaw Stormwater Education Consortium*

DO- *Dissolved Oxygen*

FC- *Fecal Coliform*

FOG- *Fats, Oils, and Grease*

HUC- *Hydrological Unit Code*

I/I- *Inflow and Infiltration*

ISO- *International Organization of Standards*

LA- *Load Allocation*

LID- *Low Impact Development*

Waccamaw Region Section 208 Water Quality Management Plan
Acronyms and Abbreviations

MAHL- *Maximum Allowable Headworks Loading*

MGD- *Million Gallons per Day*

MOS- *Margin of Safety*

MPN- *Most Probable Number*

MS4- *Municipal Separate Storm Sewer System*

ND- *No Discharge*

NERR- *National Estuarine Research Reserve*

NOAA- *National Oceanic and Atmospheric Administration*

NPDES- *National Pollutant Discharge Elimination System*

POTW- *Publicly Owned Treatment Works*

SA and SB- *State water classifications for Tidal Saltwaters.*

SC DHEC- *South Carolina Department of Health and Environmental Control*

SC DHEC,OCRM- *South Carolina Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management*

SC DNR- *South Carolina Department of Natural Resources*

SC DOT- *South Carolina Department of Transportation*

SRF- *State Revolving Fund*

SMS4- *Small Municipal Separate Storm Sewer System*

SSO- *Sanitary Sewer Overflow*

SWPPP- *Stormwater Pollution Prevention Plan*

TDR- *Transfer of Development Rights*

TMDL- *Total Maximum Daily Load*

USDA- *United States Department of Agriculture*

US EPA- *United States Environmental Protection Agency*

Waccamaw Region Section 208 Water Quality Management Plan
Acronyms and Abbreviations

UOD- *Ultimate Oxygen Demand*

USGS- *United States Geological Survey*

WLA- *Wasteload Allocation*

WSA- *Water and Sewer Authority*

WSD- *Water and Sewer District*

WWTF- *Wastewater Treatment Facility*

Chapter One: Introduction

Water is a critically important natural resource to the State of South Carolina and to our local communities. People depend on clean water for many of their basic daily needs. The management of local and regional water quality requires significant coordination between several entities on a local, state, and federal level. A watershed level perspective is the most effective means to evaluate local and regionwide water resource needs and to identify potential water quality issues. The Waccamaw Region Section 208 Water Quality Management Plan (Section 208 Plan) provides a framework to address specific water quality problems that exist in the regional watershed, and to develop a strategy to ensure that all local waterbodies meet and exceed water quality standards set forth by the United States Environmental Protection Agency (US EPA) and South Carolina Department of Health and Environmental Control (SC DHEC).

Clean Water Act

The Clean Water Act is the federal law that establishes the regulatory structure for managing direct point-source discharges and non-point sources of pollutants into the waters of the United States. The Clean Water Act also establishes a framework for several non-regulatory tools to help address water quality concerns on a local, state, regional, and national level. The end objective of this comprehensive legislation is to restore and maintain the overall quality of the nation's waters to ensure the "protection and propagation of fish, shellfish, and wildlife and recreation in and on the water".

One of the non-regulatory tools established in the Clean Water Act is outlined in Section 208, which calls for the development of regional areawide water quality management plans. Section 208 of the federal Clean Water Act is included in **Appendix A**. Following the enactment of the Clean Water Act in 1972, Section 208 required the Governor of each state to identify geographic areas within the state that had substantial water quality management problems as a result of urban and industrial development. The Governor then designated appropriate agencies to oversee the development and administration of Section 208 plans for established regions within their respective states. In 1975, the State of South Carolina delegated the task of developing Section 208 Plans to the Council of Governments (COGs) which are located throughout the state. The Central Midlands COG, Appalachian COG, Berkeley-Charleston-Dorchester COG, Lowcountry COG, Santee-Lynches COG and the Waccamaw Regional COG offices have all developed a Section 208 Plan for their respective regions. SC DHEC has developed a Section 208 plan for the remaining areas within the state.

Waccamaw Regional Council of Governments

The Waccamaw Regional Council of Governments administers several programs throughout the three-county region of Georgetown, Horry, and Williamsburg Counties, located in the northeast corner of South Carolina. The Waccamaw Region Section 208 Water Quality Management Plan (Section 208 Plan) is primarily focused on protecting the water quality of the surface water bodies located within this three-county region. However, watershed dynamics transcend political boundaries, requiring water quality management efforts on a larger regional scale. A watershed level planning process uses a series of cooperative, iterative steps to characterize existing conditions, identify and prioritize problems, define management objectives, develop protection or remediation strategies and implement and adopt selected actions as necessary. The watershed management approach that the US EPA has promoted establishes the following five guiding principles for dealing with water quality concerns:

- *Placed-based focus*- Activities should be managed in specific outlined geographic areas, known as management units, such as watershed boundaries or groundwater recharge areas.
- *Stakeholder involvement and partnerships*- Participation in management activities from a wide range of interests groups ensures that economic, social, and other community concerns are evaluated during the project

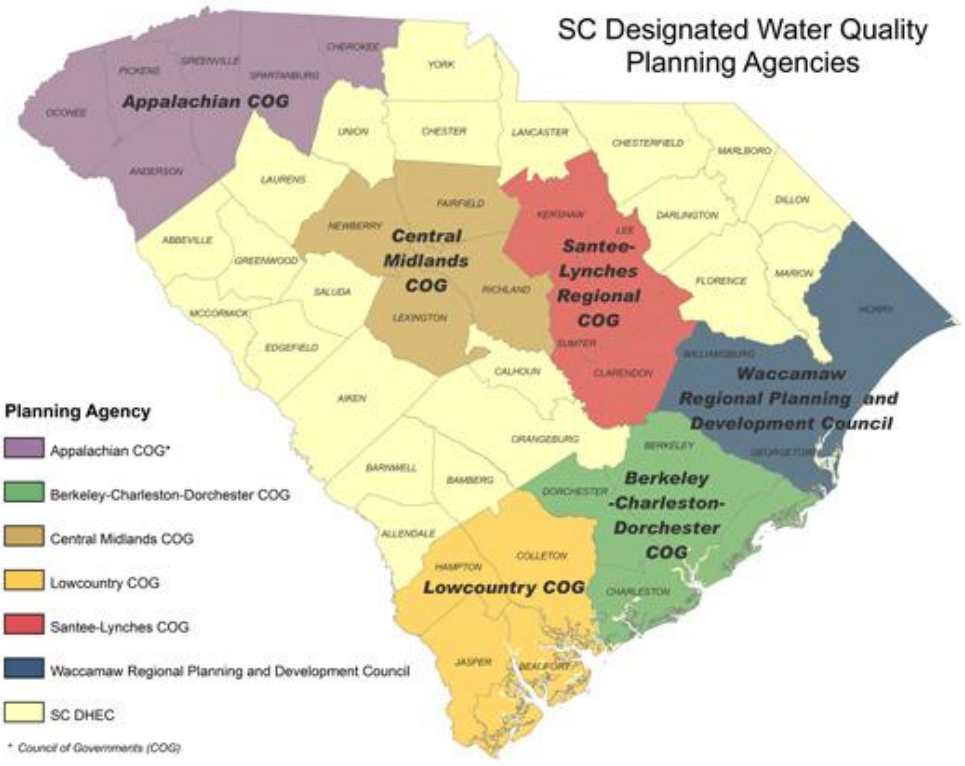
planning and implementation phase. In addition, well developed partnerships helps to ensure the long-term success of management projects.

- *Environmental goals and objectives*- Outlining concrete and specific improvement targets allows water resource managers to measure the success of watershed management projects and initiatives.
- *Problem Identification and Prioritization*- This is necessary in order to evaluate the public health risks and environmental threats of pollution concerns. Understanding the nature of the water quality concern enables water resource managers to develop a plan of action on how to direct management efforts to address water quality problems in the watershed.
- *Integration of actions*- Realizing that there is generally a finite limit to the resources available to address water quality concerns, coordination of efforts amongst all stakeholders can help identify individual responsibilities and collectively shared responsibilities to address water quality issues.

An effective water quality management plan should also integrate recommendations from other relevant planning efforts such as local government comprehensive plans. This plan assesses water quality issues throughout the entire Yadkin-Pee Dee and Santee River basins and sets forth goals and strategies to coordinate management efforts with all appropriate entities on a basin-wide scale.

The first Section 208 Plan for the Waccamaw region was adopted in 1978. Since then, the Section 208 Plan has been updated in 1981, 1986, and most recently in 1998. The opportunity to update the Section 208 Plan has been made possible by a stimulus grant authorized by the federal American Recovery and Reinvestment Act (ARRA). The Waccamaw Regional COG is a sub-recipient of a statewide grant, which has allowed for a coordinated effort to reexamine water quality issues throughout South Carolina. The Clean Water Act does not prescribe a specific mandated time cycle for designated management agencies to update their respective Section 208 Plans. This makes it critically important to take full advantage of each opportunity to review water quality findings and outline new water resource management objectives as appropriate to address current and future water quality concerns in the Waccamaw region. This Section 208 Plan is intended to have a time horizon of 15-20 years. As part of the ongoing Section 208 program, the Waccamaw Regional COG submits an annual update to SC DHEC which includes a list of Section 208 Conformance Reviews and Section 208 Plan Amendments. An objective in this plan is to expand the annual update to review other significant water quality findings and new initiatives to ensure that the Section 208 Plan remains current and relevant in the years ahead.

Below is a map that illustrates the jurisdiction of each Council of Governments office in South Carolina:



SECTION 208 PLANNING PURPOSE AND OBJECTIVES

The hydrology of a watershed system is dynamic and is constantly changing over the course of time. The watershed system is directly influenced by long-term weather patterns as well as changing land uses across the region. The Northeast region of South Carolina has undergone tremendous growth since the Waccamaw Region Section 208 Water Quality Management Plan was last revised in 1998. The local population has continued to increase at a significant pace, requiring careful attention to the region's long-term transportation, community facility, and water and sewer utility infrastructure needs.

From a regulatory perspective a stronger emphasis has been placed on stormwater permitting since the last update of the Section 208 Plan. Beginning in 1999, municipalities located within designated urbanized areas are required to obtain coverage under the National Pollutant Discharge Elimination System (NPDES) permit program. Communities that oversee Municipal Separate Storm Sewer Systems (MS4s) are now obligated to administer a stormwater management program that is focused on reducing contaminants transported to nearby surface waters via stormwater runoff. As awareness regarding water quality impacts associated with stormwater runoff and other types of non-point source pollution has increased, appropriate local and regional management strategies need to be further outlined in the Section 208 Plan.

The Section 208 Plan provides an assessment of current water quality conditions of the watersheds located in the Waccamaw region. This plan also discusses the social and economic importance of maintaining clean water to the region. New water resource management strategies are regularly emerging and innovative technologies are constantly being developed. These new approaches to water quality management are explored and appropriate recommendations are set forth to address a wide range of water quality concerns that may impact the Waccamaw region. In addition, this

plan evaluates the water quality monitoring resources needed to ensure that future water quality issues are addressed in a comprehensive and timely manner. The implementation of the Waccamaw Region Section 208 Water Quality Management Plan will require collaborative partnerships to successfully achieve the objectives outlined in this planning document. This Section 208 Plan serves as a guiding resource to fulfilling our region's obligation of meeting the expectations set forth in the federal Clean Water Act.

Figure 1.1 View of Winyah Bay from East Bay Park in Georgetown, SC

Chapter Two: Description of the Waccamaw Region Study Area

PHYSICAL SETTING AND LOCATION

The geographic boundaries of the study area for the Waccamaw Region Section 208 Water Quality Management Plan include Horry County, Georgetown County, and Williamsburg County in South Carolina. All three counties are situated in downstream portions of the Santee and Yadkin-Pee Dee River Basins. **Exhibit 2.1** provides a map of the Section 208 Plan study area. Horry County encompasses a total land area of 1,150 square miles or 736,000 acres. Horry County is a coastal county and forms a portion of the North Carolina state boundary with Brunswick County and Columbus County. Horry County is located entirely within the Yadkin-Pee Dee River Basin. Georgetown County is also a coastal county located directly south of Horry County. Georgetown County encompasses a total land area of 812.5 square miles or 520,000 acres. The Santee River forms the border between Georgetown County and Charleston County. Most of Georgetown County is located within the Yadkin-Pee Dee River Basin. The southern portions of Georgetown County are located within the Santee River Basin. Williamsburg County is located directly west of Georgetown County. It is the only county that is entirely inland in the Section 208 Plan study area. Williamsburg County encompasses a total land area of 931 square miles or 596,000 acres. Most of Williamsburg County is located within the Yadkin-Pee Dee River Basin. The southern portions of Williamsburg County are located within the Santee River Basin.

Below is a general physical and geographic description of both the Yadkin-Pee Dee River Basin and the Santee River Basin:

YADKIN-PEE DEE RIVER BASIN

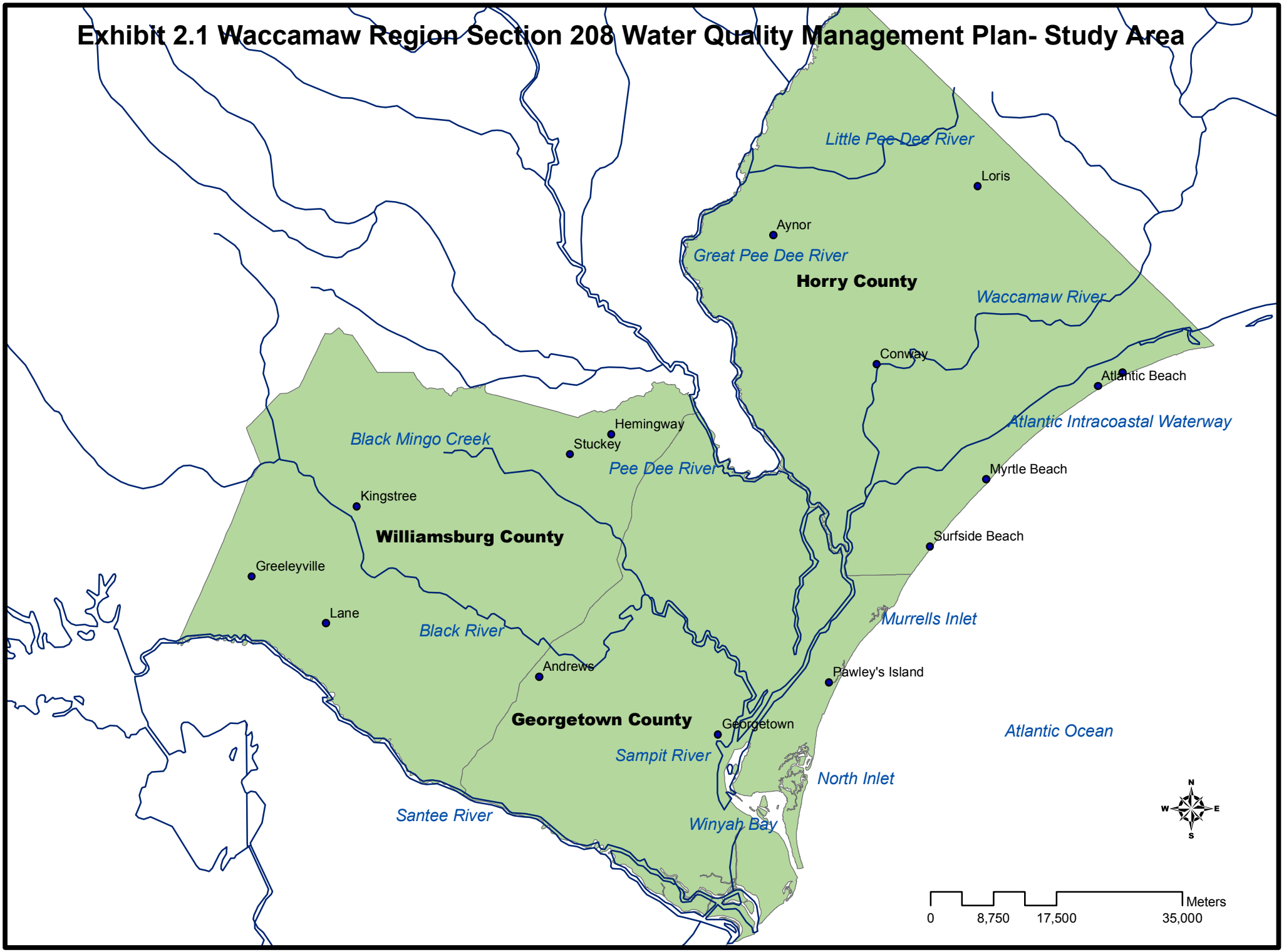
The Yadkin- Pee Dee River Basin is an extensive watershed system encompassing a total of 18,000 square miles, making it the second largest river basin on the east coast. The upstream portions of the river basin are located in the eastern section of the Blue Ridge physiographic region of North Carolina and Southwestern Virginia before flowing into the Central Piedmont region of North Carolina. The downstream portions of the basin transition into the Coastal Plain regions of North Carolina and South Carolina. The most northern reaches of the Yadkin-Pee Dee River Basin are located in the headwaters of the Ararat River watershed, a tributary of the Yadkin River, in the southern portions of Carroll and Patrick Counties in Virginia. The eastern extent of the Yadkin-Pee Dee River Basin includes the coastlines of Brunswick County, North Carolina, and Horry and Georgetown Counties in South Carolina. The major tributaries that contribute to this river basin system include the Lumber, Little Pee Dee, Lynches, Black, Waccamaw, and Uwharrie Rivers.

Within South Carolina, the Great Pee Dee River Basin traverses Marlboro, Chesterfield, Darlington, Florence, Dillon, Marion, Williamsburg, Horry, and Georgetown Counties. This portion of the Yadkin- Pee Dee River Basin includes a total of 4,669 stream miles, 10,864 acres of lake waters, and 17,676 acres of estuarine areas within 22 watersheds covering a 4,029 square mile land area. The massive Yadkin-Pee Dee River Basin ultimately drains into Winyah Bay located in Georgetown County. A more detailed description of each sub-watershed located within the Waccamaw region is provided in **Chapter Three, Watershed Assessments**.

SANTEE RIVER BASIN

The Santee River Basin encompasses a total land area of 1,280 square miles traversing parts of the Upper Coastal Plain and the Lower Coastal Plain physiographic regions of South Carolina. The Santee River is formed from the confluence of the Congaree and Wateree Rivers in the Upper Coastal Plain region of South Carolina. There are eleven separate watersheds within the river basin system including Lake Marion, Halfway Swamp Creek, Jacks Creek, Tawcaw Creek,

Exhibit 2.1 Waccamaw Region Section 208 Water Quality Management Plan- Study Area



Potato Creek, the Rediversion Canal, Wadmacon Creek, Wambaw Creek, North Santee River, South Santee River, and two hydrological units of the Santee River watershed. Within these watershed areas, there are a total of 976 stream miles, 94,668 acres of lake waters, and 5,276 acres of estuarine areas. The Santee River Basin spans across parts of Sumter, Clarendon, Calhoun, Orangeburg, Berkeley, Williamsburg, Charleston, and Georgetown Counties. A more detailed description of the sub-watersheds located within Williamsburg and Georgetown Counties is provided in **Chapter Three, Watershed Assessments.**

WACCAMAW REGION SOIL PROFILE

Soils have a significant influence on the hydrology of a watershed system. A detailed assessment of the composition of existing soils on a local site scale and a larger watershed scale is an essential aspect of water quality management. There are a number of correlations between soil systems management and water quality management. First, each type of soil has varying capabilities of eroding and migrating off the land surface into downstream surface waterbodies. Soils are naturally susceptible to erosion, however soils should be protected from unnecessary levels of erosion. Excessive soil erosion can lead to sedimentation in local rivers and streams. Sedimentation often increases the levels of turbidity in a waterbody, which can harm aquatic life habitats. Pollutants, such as animal wastes, nutrients from fertilizers, and toxic chemicals can be transported with sediment and ultimately contaminate local waterways.

Each soil type also has varying drainage capabilities. There are three soil characteristics that influence the drainage capabilities of a soil medium. The infiltration capacity is the rate at which water penetrates the soil surface. Permeability is the rate that water within the soil moves through a given volume of material. Finally, percolation is the downward movement of water through the soil. Soil types are important to identify on a site scale level of analysis in order to avoid the placement of on-site wastewater treatment systems in areas that have limited soil drainage capabilities. Larger scale land application of waste materials utilized by wastewater utility districts must also be sited in areas with suitable soil characteristics. Ongoing monitoring of both these types of wastewater treatment practices is important, as each soil type has a specific loading rate for various types of pollutants. On-site wastewater treatment systems and land application sites also have limited life spans, beyond which their ability to assimilate and treat wastewater effluent becomes diminished. A detailed profile and corresponding map displaying the types of soils commonly found within the three-county Waccamaw region is included in **Appendix E**.

WACCAMAW REGION POPULATION TRENDS

One of the fundamental steps in conducting any planning process is to evaluate population trends and projections within the planning area. An accurate assessment of population trends is invaluable to being able to meet the long-term municipal wastewater treatment service demands of local communities. Population forecasts enable sewer utility providers to construct wastewater treatment facilities at a capacity to handle current and future loading ratings. A challenging aspect of the coastal region of South Carolina is the significant number of tourists that add to the peak service demand rates in our communities, particularly in the summer months.

Table 2-1 provides historical population data at the County Census Division level for Horry, Georgetown, and Williamsburg Counties. As the table indicates, Horry County has experienced a tremendous amount of growth in the last ten years particularly along the coast and in the Conway area. Georgetown County has had more moderate growth rates since 2000, with the most substantial population increases occurring along the Waccamaw Neck. Williamsburg County has experienced a population decline since 2000. The largest population decrease occurred in the Indiantown area, while the only community within the county that had an increase in population since 2000 was the Lane CCD.

Table 2-1 Historical Population Data for the Waccamaw Region						
Horry County						
County Census Division	1970	1980	1990	2000	2010	Growth % 2000-2010
Aynor	5,634	7,190	6,786	8,909	10,052	**12.8%**
Conway	18,665	23,868	26,648	33,575	39,715	**18.3%**
Conway East	3,419	8,546	17,408	31,639	65,364	**106.6%**
Floyds Crossroads East	3,420	3,771	2,943	3,195	3,301	**3.3%**
Little River	4,960	8,781	17,833	26,315	33,652	**27.9%**
Longs	2,788	3,299	3,338	5,625	6,645	**18.1%**
Loris	9,895	11,137	11,189	13,785	15,878	**15.2%**
Myrtle Beach	21,211	34,827	57,908	73,587	94,684	**28.7%**
County Total	***69,992***	***101,419***	***144,053***	***196,630***	***269,291***	***36.9%***
Georgetown County						
County Census Division	1970	1980	1990	2000	2010	Growth % 2000-2010
Andrews	5,174	6,914	7,401	7,929	7,608	**-4.0%**
Georgetown	15,638	19,281	19,578	20,111	19,865	**-1.2%**
Plantersville	2,499	2,706	2,650	3,199	2,957	**-7.6%**
Pleasant Hill	3,059	3,518	3,553	3,994	3,592	**-10.0**
Sampit	3,977	3,519	3,440	3,918	3,913	**-0.1%**
Waccamaw	3,153	6,523	9,680	16,646	22,223	**33.5%**
County Total	***33,500***	***42,461***	***46,302***	***55,797***	***60,158***	***7.8%***
Williamsburg County						
County Census Division	1970	1980	1990	2000	2010	Growth % 2000-2010
Cades	2,703	3,126	2,769	2,681	2,409	**-10.1%**
Greeleyville	3,352	2,999	2,773	2,632	2,465	**-6.3%**
Hemingway	5,257	5,857	5,578	5,356	4,753	**-11.3%**
Indiantown	2,010	2,299	1,996	1,931	1,591	**-17.6%**
Kingstree	11,648	14,093	14,369	14,709	13,424	**-8.7%**
Lane	3,657	3,624	3,662	3,742	4,099	**9.5%**
Nesmith	3,460	3,909	3,297	3,617	3,181	**-12.1%**
Trio	2,156	2,319	2,371	2,549	2,501	**-1.9%**
County Total	***34,243***	***38,226***	***36,815***	***37,217***	***34,423***	***-7.5%***
Source: *US Census Bureau, Waccamaw Regional Council of Governments, SC Budget and Control Board*						

Table 2-2 provides twenty year population projections for each Census County Division within the Waccamaw region. Horry County is expected to continue to grow over the next twenty years. Growth is expected to occur throughout the county with the exception of the Floyds Crossroads East CCD, which is located in the northwest portion of the county. Georgetown County is also expected to experience additional population growth in the foreseeable future. Most of the county will grow at a modest rate with the exception of Sampit CCD which is expected to experience marginal growth during that time span. Meanwhile, the population in Williamsburg County is expected to remain constant on the county

level through the next two decades. Any growth that is likely to occur will be in the Kingstree, Lane, and Trio areas. The remaining portions of Williamsburg County are expected to see a population decline over the next several years.

Table 2-2 Population Projections for the Waccamaw Region

Horry County

County Census Division	2010 Census	2015	2020	2025	2030	Projected Growth 2010-2030
Aynor	10,052	10,875	11,606	12,269	12,675	**26.1%**
Conway	39,715	44,599	47,659	50,642	53,243	**34.1%**
Conway East	65,364	50,616	56,755	62,739	68,261	**0.4%**
Floyds Crossroads East	3,301	2,992	2,974	2,926	2,763	**-16.3%**
Little River	33,652	42,526	46,882	51,290	55,842	**65.9%**
Longs	6,645	7,262	7,992	8,647	9,078	**36.7%**
Loris	15,878	16,816	17,725	18,567	19,160	**20.7%**
Myrtle Beach	94,684	115,393	125,219	135,451	146,657	**54.9%**
County Total	***269,291***	***291,080***	***316,810***	***342,530***	***367,680***	***36.5%***

Georgetown County

County Census Division	2010 Census	2015	2020	2025	2030	Projected Growth 2010-2030
Andrews	7,608	9,280	9,606	9,965	10,413	**36.9%**
Georgetown	19,865	22,203	22,614	23,104	23,786	**19.7%**
Plantersville	2,957	3,438	3,572	3,696	3,799	**28.5%**
Pleasant Hill	3,592	4,388	4,527	4,667	4,812	**33.9%**
Sampit	3,913	3,892	3,934	3,965	3,983	**1.8%**
Waccamaw	22,223	22,930	25,397	27,783	30,086	**35.4%**
County Total	***60,158***	***66,130***	***69,650***	***73,180***	***76,880***	***27.8%***

Williamsburg County

County Census Division	2010 Census	2015	2020	2025	2030	Projected Growth 2010-2030
Cades	2,409	2,348	2,289	2,228	2,124	**-11.8%**
Greeleyville	2,465	2,412	2,360	2,315	2,246	**-8.8%**
Hemingway	4,753	4,783	4,635	4,488	4,303	**-9.5%**
Indiantown	1,591	1,559	1,481	1,396	1,278	**-19.7%**
Kingstree	13,424	14,145	14,098	14,055	13,906	**3.6%**
Lane	4,099	4,134	4,283	4,462	4,609	**12.4%**
Nesmith	3,181	3,224	3,250	3,261	3,158	**-0.1%**
Trio	2,501	2,635	2,704	2,775	2,816	**12.6%**
County Total	***34,423***	***35,240***	***35,100***	***34,980***	***34,440***	***0.1%***

Source: *GSATS 2035 Long Range Transportation Plan, US Census Bureau, Waccamaw Regional Council of Governments, SC Budget and Control Board*

WACCAMAW REGION LAND USE PROFILE

The hydrology of a watershed is directly influenced by the urban and rural land use activities in a region. As a result of tremendous population increases and subsequent urban development patterns, the natural hydrology of the Waccamaw region has been altered significantly over the past several decades. One of the major physical changes associated with urban development is the increase in impervious surface area that covers the landscape. From a water quality management perspective, impervious surfaces can be very problematic as they are essentially a collection point for

numerous types of pollutants that accumulate from activities common to an urban setting. These impervious surfaces are typically connected to the storm drainage system which can transport this untreated polluted runoff directly to nearby waterways. This section provides information pertaining to the physical landscape changes within the Waccamaw region between 1996 and 2006, which helps gauge the rate of urban development in each county. A more detailed review of land use practices that can help minimize the potential for non-point sources of pollution is provided in **Chapter Six, Non-point Sources of Pollution** and **Chapter Eight, Economic Development.**

The National Oceanic and Atmospheric Administration (NOAA) maintains the Coastal Change Analysis Program, which is a database of land cover change for coastal counties throughout the country. This program is a useful tool that allows planners and water resource managers to make a broad assessment of land use changes and be able to identify patterns of specific concern such as the loss of wetland acreage, as an example. The program evaluates eleven separate land cover categories. The current database includes land cover changes from 1996-2006 with a long-term intention of updating the program every five years. Below is a land coverage profile for each county. Additional land use information for each watershed in the Waccamaw region is provided in **Chapter Three, Watershed Assessments.**

Table 2-3 provides land cover change trends within Horry County between 1996 and 2006.

Table 2-3 Land Cover Change in Horry County: 1996-2006

Land Cover Categories	Land Area 1996	Land Area Lost	Land Area Gained	Land Area 2006	Net Change	Percent Change
High/ Medium Intensity Developed	13.81	0.01	6.27	20.07	6.26	45.33%
Low Intensity Developed	40.74	0.56	9.60	49.78	9.04	22.19%
Open Space Developed	32.90	0.03	11.83	44.71	11.80	35.86%
Grassland	25.94	11.03	19.62	34.53	8.59	33.11%
Agriculture	223.30	2.41	3.21	224.09	0.79	0.36%
Forested	231.89	68.09	21.02	184.81	-47.08	-20.30%
Scrub/Shrub	107.02	26.27	52.38	133.13	26.11	24.40%
Woody Wetland	427.32	37.67	4.61	394.26	-33.06	-7.74%
Emergent Wetland	22.62	3.87	15.24	33.99	11.38	50.31%
Barren Land	5.93	1.31	5.74	10.36	4.43	74.81%
Open Water	123.52	0.51	2.23	125.25	1.73	1.40%
Notes: *Land area units are in square miles Source: NOAA Coastal Services Center*						

Table 2-4 provides land cover change trends within Georgetown County between 1996 and 2006.

Table 2-4 Land Cover Change in Georgetown County: 1996-2006

Land Cover Categories	Land Area 1996	Land Area Lost	Land Area Gained	Land Area 2006	Net Change	Percent Change
High/ Medium Intensity Developed	2.37	0.00	0.60	2.96	0.59	25.13%
Low Intensity Developed	9.92	0.21	1.64	11.35	1.44	14.48%
Open Space Developed	8.34	0.02	1.77	10.10	1.76	21.07%
Grassland	20.46	13.75	32.56	39.27	18.81	91.94%
Agriculture	31.01	0.03	1.59	32.57	1.56	5.02%
Forested	305.66	85.68	50.31	270.30	-35.37	-11.57%
Scrub/Shrub	96.40	50.43	63.16	109.13	12.73	13.21%
Woody Wetland	233.39	14.67	4.53	223.25	-10.14	-4.35%
Emergent Wetland	99.94	3.73	10.30	106.51	6.57	6.57%
Barren Land	9.75	2.05	1.66	9.37	-0.38	-3.91%
Open Water	217.78	0.47	2.91	220.21	2.43	1.12%
Notes: *Land area units are in square miles Source: NOAA Coastal Services Center*						

Table 2-5 provides land cover change trends within Williamsburg County between 1996 and 2006.

Table 2-5 Land Cover Change in Williamsburg County: 1996-2006						
Land Cover Categories	**Land Area 1996**	**Land Area Lost**	**Land Area Gained**	**Land Area 2006**	**Net Change**	**Percent Change**
High/ Medium Intensity Developed	1.29	0.00	0.18	1.47	0.18	13.77%
Low Intensity Developed	7.70	0.06	0.38	8.03	0.33	4.23%
Open Space Developed	5.02	0.01	0.29	5.30	0.28	5.65%
Grassland	29.92	20.54	26.87	36.25	6.33	21.17%
Agriculture	191.23	0.22	3.43	194.43	3.20	1.68%
Forested	264.72	63.85	30.05	230.91	-33.80	-12.77%
Scrub/Shrub	111.08	29.92	58.83	139.98	28.91	26.02%
Woody Wetland	311.22	18.24	4.58	297.56	-13.66	-4.39%
Emergent Wetland	11.27	2.32	9.39	18.34	7.07	62.74
Barren Land	0.19	0.13	0.93	0.99	0.80	420.55%
Open Water	3.29	0.03	0.39	3.65	0.37	11.11%
Notes: *Land area units are in square miles Source: NOAA Coastal Services Center*						

SIGNIFICANTLY VALUABLE NATURAL RESOURCES

The Waccamaw region is an area with an abundance of unique and diverse natural habitats. Many sites within the region have exceptional value as natural resource areas. The following is a profile of several of these sites. These examples of preserved and managed lands provide the region with tremendous environmental benefits, including water quality protection.

Waccamaw National Wildlife Refuge

The Waccamaw National Wildlife Refuge is part of a nationwide network of 550 federally managed natural habitat areas established specifically for the protection of our country's wildlife. The refuge officially became part of the national system in 1997 and was established with an initial 55,000 acre acquisition boundary. At present time, 23,000 acres are permanently protected and a land acquisition program is in place as a mechanism to work with willing landowners to purchase additional tracts. The Waccamaw National Wildlife Refuge spans across parts of Horry, Georgetown, and Marion Counties and encompasses large portions of the Waccamaw, Great Pee Dee, and Little Pee Dee River watersheds. The wildlife refuge showcases a diversity of wildlife habitats including a black water river swamp, alluvial river floodplain, forested wetlands, longleaf pine ecosystems, and tidal and managed historic ricefields. These tidal freshwater wetlands are some of the most diverse freshwater wetland systems found in North America. Additionally, refuge wetlands play a critical role in filtering storm water runoff and supplying vital drinking water resources for the greater Grand Strand region. The Waccamaw National Wildlife Refuge also has several programs and facilities that are utilized for public awareness and environmental education purposes.

North Inlet-Winyah Bay National Estuarine Research Reserve (NERR)

The North Inlet-Winyah Bay NERR site is part of a system of 27 reserve locations throughout the country designated as having unique coastal habitat characteristics. These areas are protected and utilized as long-term research sites with support from the National Oceanic and Atmospheric Administration. The North Inlet-Winyah Bay site consists of approximately 12,000 acres of coastal marsh and wetlands. North Inlet-Winyah Bay NERR has established an on-site System-Wide Monitoring Program to enhance scientific understanding of temporal and spatial dynamics of estuarine ecological processes. Findings from this monitoring program are used to improve local and national coastal zone management decisions.

Hobcaw Barony

The North Inlet-Winyah Bay NERR site is part of a larger 17,500 acre protected land parcel, Hobcaw Barony, which includes other unique coastal South Carolina habitats such as former rice fields, upland hardwood and pine forests, and nearby barrier islands. This historic site is maintained by the Baruch Foundation, which was established by former land owner Belle Baruch, and is an active research center utilized by Clemson University and the University of South Carolina.

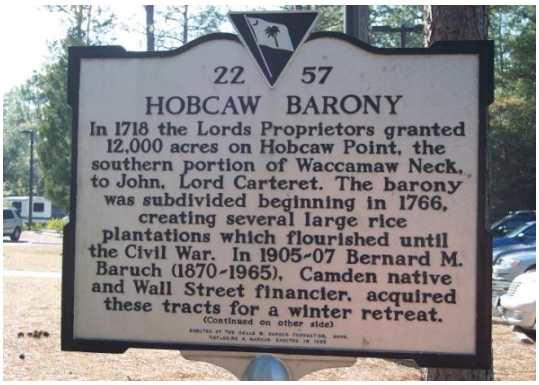


Figure 2-1 Hobcaw Barony has a rich history in the Georgetown County. Today, it is an exceptionally valuable conserved coastal habitat area.

SC Department of Natural Resources- Heritage Trust Program

The Heritage Trust Program was established in 1976 as a means to protect critical natural habitats and important cultural sites throughout the state. State enabling legislation gave the South Carolina Department of Natural Resources (SC DNR) the ability to create heritage preserve sites that would be managed and protected in perpetuity. Currently there are 70 designated Heritage Preserves throughout the state providing over 83,000 acres of protected natural habitat for local wildlife. There are four Heritage Preserves located in the Waccamaw region. Their importance in providing environmental services including, wildlife habitat areas and water quality protection, is invaluable to our region's watershed management efforts. A brief description of each Heritage Preserve is provided below.

- **Cartwheel Bay Heritage Preserve/ Wildlife Management Area:** This 568 acre site located in Horry County is one of the few remaining undisturbed Carolina Bay- longleaf pine savannah habitat complexes that are protected in the Southeast. These rare ecosystems are classified as isolated freshwater wetlands, which have unique groundwater hydrology characteristics.
- **Lewis Ocean Bay Heritage Preserve/ Wildlife Management Area:** This preserve is a 9,690 acre site in Horry County. Within the preserve there are 23 distinct Carolina Bay habitats, making it the largest undisturbed grouping of Carolina Bays in the entire state. These Carolina Bay ecosystems are classified as isolated freshwater wetlands and foster a remarkably diverse vegetative and wildlife community.
- **Tom Yawkey Wildlife Center Heritage Preserve:** This expansive management area is composed of 31 square miles of marsh, managed wetlands, longleaf pine forest, maritime forest, and other unique types of coastal habitat in Georgetown County. This pristine land area provides critical habitat for many species of plants, birds, and terrestrial wildlife.
- **Waccamaw River Heritage Preserve/ Wildlife Management Area:** This 5,347 acre site in Horry County helps protect a large undisturbed bottomland hardwood forest ecosystem within the Waccamaw River watershed. The preserve provides a significant riparian buffer corridor along the Waccamaw River enhancing the water quality benefits of the entire watershed ecosystem. The preserve provides residents and visitors several outdoor recreation opportunities and direct access to the Waccamaw River through one of seven boat landings in the area.

SC Department of Natural Resources- Scenic Rivers Program

The Scenic Rivers program was established by the South Carolina Scenic Rivers Act of 1989 and has been managed by SC DNR since its inception. The purpose of the program is to protect the "unique or outstanding scenic, recreational, geologic, botanical, fish, wildlife, historic, or cultural values" of designated river segments throughout the state. The program is structured to foster a collaborative stakeholder partnership between SC DNR and landowners, community groups, and other local entities to assess management issues within each designated Scenic River and develop conservation goals in order to ensure its long-term value to the state. A Scenic River Management Plan is drafted to

outline these goals and recommend management strategies, and a Scenic River Advisory Council is established to oversee the execution of all management initiatives. This is a great opportunity to pull together a wide range of expertise and resources to ensure that our valuable river resources are being protected and managed in a sustainable way. There are three river segments within the Waccamaw region which have been designated by SC DNR as Scenic Rivers.

- **Black River:** This important waterbody is a central feature of the natural landscape in Sumter, Williamsburg, Clarendon, and Georgetown Counties. It is a blackwater river system with an extensive area of forested swampland located in its floodplain. The Williamsburg, Clarendon, and Georgetown County Councils adopted resolutions of support for designation as a State Scenic River. In June 2001, a 75-mile segment of the Black River became South Carolina's seventh and longest State Scenic River. This scenic river segment begins at County Road #40 in Clarendon County, and extends southeast through Williamsburg County to Pea House Landing at the end of County Road #38 in Georgetown County, South Carolina.
- **Great Pee Dee River:** This prominent river is of tremendous value as a natural resource to the region. This river system has broad floodplains that in some places extend for roughly three miles in total width. The river is bordered by extensive areas of bottomland hardwood forest, making it an incredible habitat for many bird, fish, plant, and terrestrial wildlife species. In recognizing the interests of several landowners and community groups, the governor signed a bill in 2001 designating a 70 mile segment of the Great Pee Dee River as a State Scenic River. The official designation extends from the US Highway 378 bridge between Florence and Marion Counties to the US Highway 17 bridge at Winyah Bay in Georgetown County.
- **Little Pee Dee River:** This waterbody is another outstanding example of a blackwater river ecosystem in the Coastal Plain region of South Carolina. Its designation as a State Scenic River occurred in 1990. This particular segment is 14 miles in length, extending from US Highway 378 to the confluence with the Great Pee Dee River. Currently there is a single Scenic River Advisory Council for both the Great Pee Dee River and Little Pee Dee River segments.

Figure 2-2 Black River near Kingstree, SC

South Carolina Conservation Bank

In 2002, the state legislature passed the South Carolina Conservation Bank Act, which established the Land Legacy Initiative in the state. The South Carolina Conservation Bank is a program developed through this initiative with an intended purpose of identifying land areas within the state that possess uniquely valuable natural and cultural resources and providing a mechanism by which willing property owners can preserve their lands for future generations through conservation easements or by selling part of their parcels to the state.

Table 2-6 includes a list of properties in the Waccamaw region that are currently protected under a conservation easement or fee simple purchase through the South Carolina Conservation Bank. More information about the South Carolina Conservation Bank can be found online at: http://sccbank.sc.gov/

Table 2-6 South Carolina Conservation Bank- Properties in the Waccamaw Region

Name	Acreage Conserved	County
Cynthia Brown Tract	51 acres	Horry
Velma Johnson Tract	34 acres	Horry
J.M Shelley Tract	49 acres	Horry
JM and SL Shelley Tract	35 acres	Horry
JM and SL Shelley Tract	21 acres	Horry
Lacie Shelley Tract	64 acres	Horry
Robert Battle Tract	65 acres	Horry
Kyle Daniel Tract	188 acres	Georgetown
E. Hickson Tract	318 acres	Georgetown
Jones Tract/ Mt Pleasant Tr.	982 acres	Georgetown

Source: South Carolina Conservation Bank

This Page Has Been Left Blank Intentionally

Chapter Three: Watershed Assessments

South Carolina DHEC oversees an ambient surface water quality monitoring program which provides critical data and information needed to complete periodic assessments of the water quality throughout the state. This monitoring program is intended to be the primary source of data used to determine if a waterbody is meeting the water quality standards for its classified use. Chemical, physical, and biological evaluations are factored into the determination of whether a waterbody is meeting the water quality standards criteria.

In its efforts to maintain good water quality and to protect the health and welfare of the general public, the State of South Carolina has established a system of classifying the uses of all of the waterbodies throughout the state. A set of water quality criteria for each of these classifications has also been developed as part of the foundation of the SC Pollution Control Act. These regulations establish antidegradation rules and serve as the basis for wastewater discharge permit limit decisions for the NPDES program. Several other activities are also affected by this regulation including the control of toxic substances, thermal dischargers, stormwater dischargers, and dredge and fill activities. **Appendix Table B-2** provides a synopsis of each of the water classifications utilized in South Carolina.

This chapter provides a general description of each watershed that traverses the Waccamaw region. A map corresponding to each watershed general profile included in this chapter is provided in **Appendix N.** Information pertaining to the waterbodies that have been included on the 2010 SC 303(d) list is provided in **Appendix D**. A detailed description of each of the Total Maximum Daily Load (TMDL) allocations that have been developed in the Waccamaw region is included in this chapter as well. Finally, a list of waterbodies that have been identified as waters of concern in the 2010 303(d) listing cycle is provided in **Appendix D**. These waterbodies will be targeted for additional water quality assessment and review prior to the issuance of the 2012 South Carolina 303(d) list.

Pee Dee Coastal Frontage Basin, Hydrological Unit: 03040208

The Pee Dee Coastal Frontage Basin is located in Horry and Georgetown Counties, and encompasses two watersheds and 358 square miles. This coastal frontage basin drains directly into the Atlantic Ocean. Of the 228,914 acres within this basin, 59.2% is water, 14.7% is urban land, 8.8% is forested wetland, 6.7% is forested land, 5.2% is nonforested wetland, 3.5% is agricultural land, 1.2% is barren land, and 0.7% is scrub/shrub land. The urban land percentage is comprised primarily of the cities of Myrtle Beach and North Myrtle Beach.

There are approximately 92 stream miles, 155 acres of lake waters, and 3,521 acres of estuarine areas located in this basin. The Little River flows back and forth across the SC/NC state line forming a portion of the Atlantic Intracoastal Waterway (AIWW) and drains to the Atlantic Ocean through the Little River Inlet. The Grand Strand beaches and their swashes all drain to the Atlantic Ocean in this watershed, as does Murrells Inlet, Pawleys Inlet, and North Inlet and each of their respective tributaries.

Figure 3-1 Tributary of the Murrells Inlet Estuary

The Table below is a general profile of the Little River, Atlantic Intracoastal Waterway, and Murrells Inlet watershed.

General Profile of the Little River/ Atlantic Intracoastal Waterway/ Murrells Inlet HUC Unit: 03040208-03		
Counties	Horry, Georgetown, Brunswick County NC.	
Watershed Size	175,584 acres	
Surface Waterbody Size	91.5 stream miles/ 148.8 acres of lake waters/ 2,365.7 acres of estuarine areas.	
Water Classifications	All streams in the watershed are classified by the state as Shellfish Harvesting Waters (SFH) with the exception of the Atlantic Intracoastal Waterway. The Atlantic Intracoastal Waterway and its tributaries from the crossing of S.C. Highway 9 to the North Carolina state line are classified Class SA (SA), and southward from the S.C. Highway 9 crossing are classified Freshwaters (FW).	
Main Waterbodies	**Little River, Atlantic Intracoastal Waterway, Murrells Inlet**	
Tributaries/ Minor Waterbodies	**South Carolina Tributaries:** Dunn Sound Creek, Dunn Sound, Sheephead Creek, Hog Inlet, House Creek, Cherry Grove Inlet, Eden Saltworks Creek, Williams Creek, Salt Flat Creek, Nixon Creek, Little River Swamp, Prices Swamp, Camp Branch Run, White Point Creek, Long Pond, Long Branch, Canepatch Swamp, Black Creek, Whale Creek, Main Creek, Woodland Creek, Parsonage Creek, Flagg Creek, Allston Creek, Oaks Creek, Oyster Cove **North Carolina Tributaries:** Mullet Creek, Calabash Creek, Milliken Cove, Horseford Creek. **Waterbodies which drain directly into Atlantic Ocean:** Singleton Swash, Bear Creek, Canpatch Swash, withers Swash, Midway Swash.	
Land Use Breakdown	**Urban Land**	**18.0%**
	Forested Land	**6.6%**
	Forested Wetland	**7.6%**
	Non-forested Wetland	**0%**
	Agricultural Land	**4.1%**
	Scrub/shrub Land	**3.6%**
	Water	**57.5%**
	Barren Land	**1.2%**
NOTES:	**Two Separate TMDLs are in place within this watershed. One is a Dissolved Oxygen TMDL along the Waccamaw River/ Atlantic Intracoastal Waterway and the second is a Fecal Coliform TMDL in Murrells Inlet. Sixteen monitoring sites within this watershed have been identified as Waters of Concern in the 2010 SC 303(d) list.**	
Source: *SC Department of Health and Environmental Control. 2007 Pee Dee River Basin Watershed Water Quality Assessment.*		

Due to its close proximity to the Atlantic Ocean and the heavily visited Grand Strand beaches, the Little River/ Atlantic Intracoastal Waterway/ Murrells Inlet is likely to continue to experience significant growth into the foreseeable future. Development trends have fluctuated due to the economic recession of the late 2000's, however one possible trend is the increase in permanent year-round residents as the coastal South Carolina region continues to become an attractive retirement destination. Additional residential and commercial development is likely as the region seeks to diversify the local economic base and attract new industries to the area. Most of this watershed has access to centralized sewer service.

Appendix Table D5 includes a list of waters in the Little River/ Atlantic Intracoastal Waterway that have been identified by SC DHEC as Waters of Concern following the 2010 water quality assessment. These waterbodies will be targeted for additional investigation prior to the next biannual release of the 303 (d) list of impaired waters.

The Table below is a general profile of the North Inlet watershed located in Georgetown County.

General Profile of the North Inlet Watershed HUC Unit: 03040208-04		
Counties	Georgetown	
Watershed Size	53,330 acres	
Surface Waterbody Size	6.6 acres of lake waters/ 1,155.2 acres of estuarine areas	
Water Classifications	Classifications provided in list of waterbodies below	
Main Waterbodies	North Inlet (ORW), Midway Inlet, Pawleys Inlet(SFH)	
Tributaries/ Minor Waterbodies	**Waterbodies classified as Outstanding Resource Waters (ORW):** Wood Creek , Double Prong Creek, Little Wood Creek, Duck Creek, Perry Creek, Bobs Garden Creek, Clambank Creek, Bread and Butter Creek, Old Man Creek, Bly Creek, Sea Creek Bay, Bass Hole Creek, Bass Hole Bay, Cooks Creek. **Waterbodies classified as Shellfish Harvesting Waters (SFH):** Cutoff Creek, Mud Creek. **Waterbodies classified as Class SB (SB):** Sawmill Creek **Other Classifications:** Jones Creek (SB, SFH, ORW), Town Creek (SA, SFH, ORW), Sixty Bass Creek (SFH,ORW), Debidue Creek(SFH,ORW).	
Land Use Breakdown	**Urban Land**	**4.2%**
	Forested Land	**7.0%**
	Forested Wetland	**12.4%**
	Nonforested Wetland	**10.7%**
	Agricultural Land	**1.5%**
	Scrub/shrub Land	**0.5%**
	Water	**62.3%**
	Barren Land	**1.4%**
NOTES:	**Fecal Coliform TMDL in place. A full overview is provided later in this chapter.**	
Source: *SC Department of Health and Environmental Control. 2007 Pee Dee River Basin Watershed Water Quality Assessment.*		

The northern portions of the North Inlet watershed near the Town of Pawleys Island is expected to experience increased population growth and continued development in the foreseeable future. Most of the Waccamaw Neck region of this watershed now has centralized sewer service available. However, there are still many areas along the Waccamaw Neck that are still reliant on septic systems. The Marysville community in particular has several residences that have experienced malfunctioning septic systems over the last few years. The southern half of this watershed is expected to experience a very limited amount of development over the next several decades, as much of this land is protected and managed by the North Inlet-Winyah Bay NERR and Hobcaw Barony.

Waccamaw River Basin, Hydrological Unit: 03040206

The Waccamaw River Basin is located in Horry and Georgetown Counties, and encompasses five watersheds and 765 square miles. Of the almost half million acres, 36.9% is forested wetland, 26.5% is agricultural land, 19.2% is forested land, 10.5% is urban land, 2.8% is scrub/shrub land, 2.2% is nonforested wetland, 1.7% is water, and 0.2% is barren land. The urban land percentage is comprised mostly of the cities of Conway, Georgetown, Myrtle Beach, and North Myrtle Beach. There are approximately 784 stream miles, 2,373 acres of lake waters, and 22,910 acres of estuarine areas in this watershed. The Waccamaw River flows across the South Carolina state line from North Carolina and accepts drainage from Kingston Lake and the Atlantic Intracoastal Waterway via Socastee Creek. The Waccamaw River then joins the Great Pee Dee River as it forms Winyah Bay and drains into the Atlantic Ocean.

The Table below is a general profile of the Juniper Swamp watershed located in Horry County.

General Profile of the Juniper Swamp Watershed HUC Unit: 03040206-05		
Counties	Horry	
Watershed Size	56,360 acres	
Surface Waterbody Size	132.1 stream miles/ 19.8 acres of lake waters	
Water Classifications	All waterbodies are classified as Freshwaters (FW)	
Main Waterbodies	Juniper Swamp	
Tributaries/ Minor Waterbodies	Tools Fork	
Land Use Breakdown	**Urban Land**	**6.5%**
	Forested Land	**13.0%**
	Forested Wetland	**31.0%**
	Non-forested Wetland	**0.6%**
	Agricultural Land	**45.7%**
	Scrub/shrub Land	**3.1%**
	Water	**0.1%**
	Barren Land	**0%**
NOTES:	**There are no portions of this watershed listed on the 2010 South Carolina 303(d) List of Impaired Waters.**	
Source: *SC Department of Health and Environmental Control. 2007 Pee Dee River Basin Watershed Water Quality Assessment.*		

The potential for growth within the Juniper Swamp watershed is limited in the foreseeable future. This watershed contains part of the City of Loris, which has experienced a stable population over the past few decades. There is water and sewer service available in the Loris area, which could potentially accommodate additional growth. The remaining portions of the watershed have been traditionally rural with mostly agricultural and silvilculture land use activity.

The Table below is a general profile of the Hydrological Unit-03040206-07 segment of the Waccamaw River watershed.

General Profile of the Waccamaw River Watershed HUC Unit: 03040206-07		
Counties	Horry	
Watershed Size	157,690 acres	
Surface Waterbody Size	335.6 stream miles/ 84.0 acres of lake waters	
Water Classifications	All waterbodies are classified as Freshwaters (FW)	
Main Waterbodies	Waccamaw River	
Tributaries/ Minor Waterbodies	Indigo Branch, Bellamy Branch, Cold Water Branch, Meetinghouse Branch, Mill Swamp, Buck Creek, Round Swamp, Sheepbridge Branch, Camp Swamp, Little Cedar Branch, Cedar Branch, Big Cedar Branch, Deep Branch, Simpson Creek, Mill Branch, Bear Branch, West Bear Branch, Neal Branch, Cowpen Swamp, Little Cowpen Swamp, Flat Bay, Floyd Bay, Big Swamp, Todo Swamp, Thoroughfare Bay, Frank Branch.	
Land Use Breakdown	**Urban Land**	**7.4%**
	Forested Land	**22.0%**
	Forested Wetland	**36.1%**
	Non-forested Wetland	**1.0%**
	Agricultural Land	**30.0%**
	Scrub/shrub Land	**3.1%**
	Water	**0.3%**
	Barren Land	**0.1%**
Source: *SC Department of Health and Environmental Control. 2007 Pee Dee River Basin Watershed Water Quality Assessment.*		

This portion of the Waccamaw River watershed is expected to experience continued growth into the foreseeable future. The highest development potential is west of North Myrtle Beach. In addition, growth is anticipated along the SC Highway 90 corridor, which connects the City of Conway to the North Myrtle Beach area. Other areas with significant growth potential include the SC Highway 9 corridor which connects the North Myrtle Beach area to western portions of Horry County.

The Table below is a general profile of the Kingston Lake watershed located in Horry County.

General Profile of the Kingston Lake Watershed HUC Unit: 03040206-08		
Counties	Horry	
Watershed Size	83,448 acres	
Surface Waterbody Size	183.8 stream miles/ 161.8 acres of lake waters	
Water Classifications	All waterbodies are classified as Freshwaters (FW)	
Main Waterbodies	Kingston Lake	
Tributaries/ Minor Waterbodies	Jacks Bay, Alligator Swamp, White Oak Swamp, Little White Oak Swamp, Cane Branch, Horsepen Branch, Huckleberry Branch, Bug Swamp, Bay Gully Branch, Bayboro Branch, Hellhole Swamp, Fox Branch, Camp Swamp, Horsepen Creek, Maple Swamp, Big Baxter Swamp, Little Baxter Swamp, Horse Creek, Cross Branch, Poplar Swamp, Booth Branch, Smith Branch, Boggy Swamp, Grier Swamp, Priver Branch, Mill Branch, Long Swamp, St. Paul Branch, Brown Swamp, Mary Branch, Crab Tree Swamp, Ned Creek, Thomspon Swamp, Oakey Swamp, Beaver Hole Swamp Altman Branch.	
Land Use Breakdown	**Urban Land**	**8.7%**
	Forested Land	**16.6%**
	Forested Wetland	**32.5%**
	Non-forested Wetland	**0.6%**
	Agricultural Land	**39.2%**
	Scrub/shrub Land	**2.2%**
	Water	**0.2%**
	Barren Land	**0%**
NOTES:	**Section 319 Grant project conducted within watershed to investigate causes of fecal coliform bacteria and dissolved oxygen impairments**	
Source: *SC Department of Health and Environmental Control. 2007 Pee Dee River Basin Watershed Water Quality Assessment.*		

The Kingston Lake watershed includes a significant portion of the City of Conway, which has been one of the fastest growing areas in the Waccamaw region over the last twenty years. Growth in Conway and the surrounding area is expected to continue over the next several years. The watershed is also accessible by several key highway corridors including US Highway 501 and US Highway 701. A large proportion of the Kingston Lake watershed is serviced by centrailized sewer and extension of service via the Grand Strand WSA Rural Sewer Program is expected to continue. The extensive floodplains associated with the Kingston Lake watershed is one of the long-term limiting factors to future growth in this part of Horry County.

Figure 3-2 provides a map of the Kingston Lake watershed in central Horry County.

Figure 3-2 Kingston Lake Watershed in Horry County, SC. New HUC watershed code for the Kingston Lake Watershed is 03040206-08 *Courtesy of Waccamaw Watershed Academy, Coastal Carolina University*

The Table below is a general profile of the Hydrological Unit-03040206-09 segment of the Waccamaw River watershed.

General Profile of the Waccamaw River Watershed HUC Unit: 03040206-09		
Counties	Horry	
Watershed Size	136,317 acres	
Surface Waterbody Size	226.2 stream miles/ 477.1 acres of lake waters	
Water Classifications	All waterbodies classified as Freshwaters (FW)	
Main Waterbodies	Waccamaw River	
Tributaries/ Minor Waterbodies	Jones Big Swamp, Boggy Swamp, Horse Savannah, Watts Bay, Stanley Creek, Beaverdam Swamp, Big Swamp, Tilly Swamp, Tiger Bay, Cane Bay, Buck Bay, Long Branch, Round Swamp, Dam Swamp, Steritt Swamp, Bear Swamp, Butler Swamp, Willow Springs Branch, Busbee Lake, Pitch Lodge Lake, Cox Ferry Lake, Thorofare Creek, Wadus Lake, Gravely Gully, Halfway Swamp, Big Branch, Old Womans Lake, Big Buckskin Creek, Peachtree Lake, Socastee Swamp, Folly Swamp, Socastee Creek, Enterprise Creek.	
Land Use Breakdown	**Urban Land**	**15.5%**
	Forested Land	**19.0%**
	Forested Wetland	**44.6%**
	Non-forested Wetland	**1.5%**
	Agricultural Land	**14.8%**
	Scrub/shrub Land	**2.8%**
	Water	**1.6%**
	Barren Land	**0.2%**
NOTES:	**Dissolved Oxygen TMDL in place. A full overview is provided later in this chapter.**	
Source: *SC Department of Health and Environmental Control. 2007 Pee Dee River Basin Watershed Water Quality Assessment.*		

This section of the Waccamaw River watershed includes part of the City of Conway and several urbanized areas of Horry County on the outskirts of Myrtle Beach and North Myrtle Beach. The watershed includes highly developed areas along US Highway 501, US Highway 17 Bypass, and SC Highway 544. These areas all have grown substantially over the last twenty years and will continue to be the primary growth corridors in Horry County into the foreseeable future. Much of this area is serviced by centralized sewer.

The Table below is a general profile of the Hydrological Unit-03040206-10 segment of the Waccamaw River watershed.

General Profile of the Waccamaw River Watershed HUC Unit: 03040206-10		
Counties	Horry, Georgetown	
Watershed Size	55,596 acres	
Surface Waterbody Size	117.5 stream miles/ 581.6 acres of lake waters/ 3,493.6 acres of estuarine areas	
Water Classifications	All waterbodies classified as Freshwaters (FW), except tributaries downtstream of the confluence with Thoroughfare Creek which is classified as Class SA (SA)	
Main Waterbodies	Waccamaw River	
Tributaries/ Minor Waterbodies	Oatbed Creek, Seven Prongs, Peach Creek, Old River, Nimrod Creek, Clark Creek, Big Swamp, Old Dock Creek, Righthand Creek, Silvers Creek. Bull Creek, Prince Creek, Vaux Creek, Silver Creek, Collins Creek, Cow House Creek, Black Creek, White Creek, Sandhole Creek, Ruinsville Creek, Crane Creek, Springfield Creek, Brookgreen Creek, Pawleys Creek, Oatland Creek, Waverly Creek, Butler Creek, Schooner Creek, Caledonia Creek, Duncan Creek, Jericho Creek	
Land Use Breakdown	**Urban Land**	**13.6%**
	Forested Land	**21.6%**
	Forested Wetland	**33.3%**
	Non-forested Wetland	**11.1%**
	Agricultural Land	**6.9%**
	Scrub/shrub Land	**2.9%**
	Water	**9.6%**
	Barren Land	**1.0%**
NOTES:	**Dissolved Oxygen TMDL in place. A full overview is provided later in this chapter.**	
Source: *SC Department of Health and Environmental Control. 2007 Pee Dee River Basin Watershed Water Quality Assessment.*		

This section of the Waccamaw River watershed includes portions of the greater Surfside Beach and Murrells Inlet areas, which are popular coastal communities. These areas are expected to continue to grow over the next several years. This portion of the watershed is served by centralized sewer. The Bucksport community is the only significantly developed area west of the Waccamaw River within this portion of the watershed. The Bucksport area has not experienced significant growth over the last twenty years but has convenient access to US Highway 701 and has moderate potential for industrial development. The Bucksport area is served by centralized sewer. The remaining portions of this section of the Waccamaw River watershed are predominantly rural and are not expected to experience significant development in the foreseeable future.

Figure 3-3 Brookgreen Creek in Georgetown County

Great Pee Dee River Basin, Hydrological Units: 03040201, 03040203, 03040204, 03040207

The Great Pee Dee River Basin is located in Marlboro, Chesterfield, Darlington, Florence, Dillon, Marion, Williamsburg, Horry, and Georgetown Counties, and encompasses 22 watersheds and 4,029 square miles within South Carolina, including the Lynches River, Black River, and Waccamaw River basins. The Great Pee Dee River flows across the Sandhills region to the Upper and Lower Coastal Plain regions and into the Coastal Zone region. Of the approximately 2.5 million acres, 33.4% is agricultural land, 25.7% is forested land, 27.9% is forested wetland, 6.3% is urban land, 2.7% is scrub/shrub land, 2.6% is water, 1.2% is nonforested wetland, and 0.2% is barren land. The urban land percentage is comprised chiefly of the cities of Florence, Darlington, Bennettsville, and Dillon.

In the Great Pee Dee River Basin, there are approximately 4,669 stream miles, 10,864 acres of lake waters, and 17,676 acres of estuarine areas. The Great Pee Dee River flows across the North Carolina/South Carolina state line and accepts drainage from Thompson Creek, Crooked Creek, Cedar Creek, Three Creeks, and Black Creek. The river then accepts drainage from Jeffries Creek, Catfish Creek, the Lynches River Basin, the Little Pee Dee River, the Black River Basin and the Waccamaw River Basin before draining into Winyah Bay.

The Table below is a general profile of the Lumber River watershed.

General Profile of the Lumber River Watershed HUC Unit: 03040203-14		
Counties	Dillon, Marion, Horry	
Watershed Size	66,605 acres	
Surface Waterbody Size	101.4 stream miles/ 70.5 acres of lake waters	
Water Classifications	All waterbodies are classified as Freshwaters (FW)	
Main Waterbodies	Lumber River	
Tributaries/ Minor Waterbodies	Ashpole Swamp, Jordan Creek, Feathery Bay, Granger Pond, Gapway Swamp, Hook Branch, Boggy Branch, Pew Branch	
Land Use Breakdown	**Urban Land**	**4.2%**
	Forested Land	**15.5%**
	Forested Wetland	**38.9%**
	Non-forested Wetland	**0.6%**
	Agricultural Land	**39.4%**
	Scrub/shrub Land	**1.1%**
	Water	**0.3%**
	Barren Land	**0%**
Source: *SC Department of Health and Environmental Control. 2007 Pee Dee River Basin Watershed Water Quality Assessment.*		

Only a small portion of the Lumber River watershed is located in Horry County. The closest developed areas are Nichols in Marion County and Lake View in Dillon County. Neither of these communities are expected to experience significant growth in the foreseeable future.

The Table below is a general profile of the Lake Swamp watershed.

General Profile of the Lake Swamp Watershed HUC Unit: 03040204-06		
Counties	Horry	
Watershed Size	114,286 acres	
Surface Waterbody Size	274.1stream miles/ 169.4 acres of lake waters	
Water Classifications	All waterbodies classified as Freshwaters (FW)	
Main Waterbodies	Lake Swamp	
Tributaries/ Minor Waterbodies	Mitchell Swamp, Haggins Creek, Calf Ford Branch, Skeebo Branch, Savannah Branch, Mill Branch, Seed Tick Branch, Iron Springs Swamp, Iron Springs Bay, Bobs Branch, Pinelog Branch, Long Branch, Pleasant Meadow Swamp, Gaskins Branch, Holmes Branch, Spring Branch, Big Branch, Fifth Branch, Rooty Branch, Playcard Swamp, Zeeks Branch, Pasture Branch, Chickencoop Branch, Daniel Hole Branch, Leather String Branch, Breakfast Swamp, Prince Mill Swamp, Little Mill Branch, Big Mill Branch, Limerick Branch, Honey Camp Branch, Rattlesnake Branch, Reedy Branch. Joiner Swamp, Joiner Bay, Bogue Bay, Loosing Swamp, Watery Bay, Turf Camp Bay, Mose Swamp, Horsepen Bay, Loosing Swamp, Johnny Lake.	
Land Use Breakdown	**Urban Land**	**5.9%**
	Forested Land	**11.8%**
	Forested Wetland	**33.9%**
	Non-forested Wetland	**0.5%**
	Agricultural Land	**46.9%**
	Scrub/shrub Land	**0.9%**
	Water	**0.1%**
	Barren Land	**0%**
Source: *SC Department of Health and Environmental Control. 2007 Pee Dee River Basin Watershed Water Quality Assessment.*		

The Table below is a general profile of the Brunson Swamp watershed.

General Profile of the Brunson Swamp Watershed HUC Unit: 03040204-07		
Counties	Horry	
Watershed Size	44,600 acres	
Surface Waterbody Size	83.0 stream miles/ 73.0 acres of lake waters	
Water Classifications	All waterbodies classified as Freshwaters (FW)	
Main Waterbodies	Brunson Swamp	
Tributaries/ Minor Waterbodies	Chinners Swamp, Rabon Branch, Mill Branch, Savannah Creek, Big Swamp, Schoolhouse Branch, Evans Branch, Spring Swamp, Holly Hill Branch	
Land Use Breakdown	**Urban Land**	**6.0%**
	Forested Land	**17.4%**
	Forested Wetland	**30.8%**
	Nonforested Wetland	**0.6%**
	Agricultural Land	**43.9%**
	Scrub/shrub Land	**1.2%**
	Water	**0.1%**
	Barren Land	**0%**
NOTES:	**TMDL in place in the Chinners Swamp subwatershed. A detailed overview of this TMDL is provided later in this chapter.**	
Source: *SC Department of Health and Environmental Control. 2007 Pee Dee River Basin Watershed Water Quality Assessment.*		

The Lake Swamp watershed encompasses a portion of the City of Loris in western Horry County. The City of Loris has experienced only modest growth over the last twenty years. Centralized sewer service is available in Loris and the immediate surrounding area. Outside of Loris the remainder of the watershed is rural, consisting of mostly agriculture and silviculture land uses. New development is expected to be limited in the near future. The Brunson Swamp watershed is also located in western Horry County and encompasses the Town of Aynor. Development within this watershed has been relatively modest however, the Town of Aynor now has full connection to the Grand Strand WSA centralized sewer network and US Highway 501, a major roadway corridor, bisects the Brunson Swamp watershed. Both of these factors could foster future growth in this part of Horry County.

The Table below is a general profile of the Little Pee Dee River watershed.

General Profile of the Little Pee Dee River Watershed HUC Unit: 03040204-08		
Counties	Marion, Horry	
Watershed Size	217,821 acres	
Surface Waterbody Size	326.3 stream miles/ 668.8 acres of lake waters	
Water Classifications	All waterbodies classified as Outstanding Resource Waters with the exception of the following waterbodies which are classified as Freshwaters (FW): Brown Swamp, White Oak Creek, Hunting Swamp, and Palmetto Swamp along with their tributaries.	
Main Waterbodies	Little Pee Dee River	
Tributaries/ Minor Waterbodies	**Tributaries:** Cedar Creek, Cow Bog, Juniper Bay, Spring Bay, Mossy Bay, Back Swamp, Cartwheel Branch, Cartwheel Bay, Fifteenmile Bay, Jet Branch, Brown Swamp, White Oak Creek, Fowler Branch, Black Creek, Flat Bay, and Turkey Pen Swamp, Gunter Bay, Hannah Bay, Wolf Pit Bay, Mill Bay, Lake Swamp, Dawsey Swamp, Tredwell Swamp, Mill Swamp, The Falls, Back Swamp, Fox Bay, Sandy Slough, Little Reedy Creek, Cane Bay, Mill Bay, Reedy Creek, Big Sister Bay, Little Sister Bay, Reedy Creek Bay, Smith Millpond, Leggett Millpond, Sandy Slough, Cypress Creek, Marsh Creek, Alligator Run, Palmetto Swamp, Little Palmetto Swamp, Ratan Branch, Giles Bay, Singleton Creek, Dwight Creek, Red Hill Branch, Alfred Creek, Bunker Hill Creek, Church Branch, Running Branch, Brown Swamp, Brown Bay, Knotty Branch, Cooper Branch, Davis Branch, Juniper Bay, Calhoun Branch, Todd Mill Branch, Lewis Mill Branch, Alkinson Branch, Jordan Lake, Old River Lake, Hunting Swamp, Boyd Canal, Jenkins Swamp, Cedar Grove Branch, Cates Bay, Forney Branch, Brownway Branch, Big Cypress Swamp, Sarah Branch, Pawley Swamp, Russ Creek, Jiles Creek, Russ Lake **Oxbow Lakes:** Cox Lake, Newfound Lake, Gunter Lake, Johnson Big Lake, Cannon Lake, Jordan Lake, Old River Lake, Richard Lake, Sampson Lakes, Dead River.	
Land Use Breakdown	**Urban Land**	**4.1%**
	Forested Land	**16.1%**
	Forested Wetland	**45.3%**
	Nonforested Wetland	**0.8%**
	Agricultural Land	**30.3%**
	Scrub/shrub Land	**2.3%**
	Water	**1.1%**
	Barren Land	**0%**
Source: *SC Department of Health and Environmental Control. 2007 Pee Dee River Basin Watershed Water Quality Assessment.*		

This section of the Little Pee Dee River watershed traverses a very rural portion of western Horry County. The most well developed portion of this watershed is the City of Mullins in Marion County. US Highway 501 does intersect the watershed in a few locations which could lead to some limited residential and commercial growth in the future.

Figure 3-4 This segment of the Little Pee Dee River is designated as a SC Scenic River. *Photo courtesy of SC Department of Natural Resources*

The Table below is a general profile of the Sampit River watershed.

General Profile of the Sampit River Watershed HUC Unit: 03040207-01		
Counties	Georgetown	
Watershed Size	105,260 acres	
Surface Waterbody Size	166.1 stream miles/ 819.8 acres of lake waters/ 1,033.5 acres of estuarine areas.	
Water Classifications	All waterbodies classified as Freshwaters (FW), except for the Sampit River which can be classified as Class SB (SB) depending on the freshwater inflow from the neighboring rivers, Great Pee Dee River and the Waccamaw River.	
Main Waterbodies	Sampit River	
Tributaries/ Minor Waterbodies	Bond Swamp, Boety Bay, Mackey Bay, Bind Bay, Canaan Bay, Ditch Branch, Canaan Branch, Summons Swamp, Boggy Swamp, Cherryhill Swamp, Machine Branch, Britt Branch, Spring Gully, Little Kilsock Bay, Ports Creek, Canaan Branch, Pennyroyal Creek, Big Kilsock Bay, Flat Bay, Turkey Creek, Whites Creek.	
Land Use Breakdown	**Urban Land**	**5.0%**
	Forested Land	**48.4%**
	Forested Wetland	**19.8%**
	Nonforested Wetland	**3.4%**
	Agricultural Land	**12.8%**
	Scrub/shrub Land	**8.7%**
	Water	**1.6%**
	Barren Land	**0.3%**
Source: *SC Department of Health and Environmental Control. 2007 Pee Dee River Basin Watershed Water Quality Assessment.*		

The City of Georgetown is one of the oldest communities in the State of South Carolina. The Sampit River is an actively used waterway for recreational, commercial, and industrial purposes. There are several areas in Georgetown that have waterfront residential and commercial developments on the Sampit River. The Town of Andrews is connected by US Highway 521, which intersects the watershed. Although there has not been as much growth in the Sampit River watershed area over the past twenty years as in other coastal areas of within the Waccamaw region, the potential for growth in this portion of Georgetown County is significant.

Figure 3-5 The Sampit River forms Georgetown Harbor, a waterway utilized for a multitude of purposes including recreational boating and as a site for local industries.

The Table below is a general profile of the Great Pee Dee River/ Winyah Bay watershed.

General Profile of the Great Pee Dee River/ Winyah Bay Watershed HUC Unit: 03040207-02		
Counties	Marion, Florence, Williamsburg, Georgetown, Horry	
Watershed Size	259,235 acres	
Surface Waterbody Size	351.9 stream miles/ 629.6 acres of lake waters/ 16,642.3 acres of estuarine areas.	
Water Classifications	Classifications provided in list of waterbodies below	
Main Waterbodies	Great Pee Dee River and Winyah Bay	
Tributaries/ Minor Waterbodies	**Waterbodies classified as Freshwaters (FW):** Crooked Lake , Negro Lake Run, Maple Swamp, Clark Creek, Muddy Creek, Mill Creek, Soccee Swamp, Island Branch, Cedar Branch, Apple Orchard Slough, Staple Lake, Clark Creek, Jacobs Creek, Port Creek, Flat Run Swamp, Boser Swamp, Squirrel Run Bay, Pennyroyal Swamp, Bells Swamp, Tyler Creek, Larrimore Gully, Gravel Gully Branch, Jordan Lake, Jordan Creek, Dog Lake, Conch Creek, Sally Branch, Bradley Branch, Sheep Pen Branch, Bull Creek, Cowford Swamp, Horsepen Branch, Vandross Bay, Yauhannah Creek, Tupelo Bay, Pole Castle Branch, St. Pauls Branch, Cypress Creek, Chapel Creek, Little Bull Creek, Bull Creek, Cooter Creek, Joe Bay, Little Bull Creek, Thoroughfare Creek, Guendalose Creek/Bullins Creek, Squirrel Creek, Jericho Creek, Middleton Cut, Carr Creek, Little Carr Creek, Jericho Creek. **Waterbodies classified as Class SB (SB):** White Oak Bay, Kinloch Creek, Mosquito Creek, Lagoon Creek, Western Channel, Mud Bay, No Mans Friend Creek, Haulover Creek, Sign Creek, Jones Creek, Dividing Creek, Nancy Creek, Noble Slough, Cotton Patch Creek, Oyster Bay, Sawmill Creek **Waterbodies classified as Class SA (SA):** Esterville Minim Creek Canal **Waterbodies classified as Shellfish Harvesting Waters (SFH):** Little Jones Creek, Cutoff Creek **Waterbodies classified as Outstanding Resource Waters (ORW):** Boor Creek **Other Classifications:** Jones Creek (SB, SFH, ORW), Town Creek (SB, SFH, ORW)	
Land Use Breakdown:	**Urban Land**	**2.4%**
	Forested Land	**22.6%**
	Forested Wetland	**30.0%**
	Nonforested Wetland	**6.9%**
	Agricultural Land	**14.2%**
	Scrub/shrub Land	**3.2%**
	Water	**20.3%**
	Barren Land	**0.4%**
Source: *SC Department of Health and Environmental Control. 2007 Pee Dee River Basin Watershed Water Quality Assessment.*		

This watershed unit extends from the southeast portions of Williamsburg, Florence, and Marion Counties through northwest Georgetown County before entering Winyah Bay just north of the City of Georgetown. This watershed is predominately rural, with a few areas of existing development including the Town of Hemingway and the outskirts of Georgetown. The potential for future growth is primarily limited to the US Highway 701 corridor, although overall growth in this area is expected to be moderate.

Lynches River Basin, Hydrological Unit: 03040202

The Lynches River Basin is located in Lancaster, Chesterfield, Kershaw, Lee, Darlington, Sumter, Florence, and Williamsburg Counties, and encompasses 1,412.3 square miles with geographic regions that extend from the Piedmont to the Sandhills, and to the Upper and Lower Coastal Plains. The Lynches River Basin encompasses seven watersheds and 903,879 acres, of which 38.5% is agricultural land, 33.4% is forested land, 20.1% is forested wetland, 5.4% is urban land, 2.0% is scrub/shrub land, 0.3% is water, 0.2% is nonforested wetland, and 0.1% is barren land. The urban land percentage is comprised chiefly of the City of Lake City.

This predominantly rural area has approximately 1,807 stream miles and 1,310 acres of lake waters. The Lynches River originates in North Carolina and accepts drainage from the Little Lynches River, Sparrow Swamp, and Lake Swamp before draining into the Great Pee Dee River.

The Table below is a general profile of the Lake Swamp watershed.

General Profile of the Lake Swamp Watershed HUC Unit: 03040202-06		
Counties	Florence, Williamsburg	
Watershed Size	105,066 acres	
Surface Waterbody Size	152.9 stream miles/ 71.1 acres of lake waters.	
Water Classifications	All waterbodies classified as Freshwaters (FW)	
Main Waterbodies	Lake Swamp	
Tributaries/ Minor Waterbodies	Twomile Branch, Cypress Branch, Sandy Run Branch, Spring Run, Camp Branch, Smith Swamp, Spring Bay, Grahams Mill Branch, Graham Branch, McNamee Swamp, Singleton Swamp, Long Branch	
Land Use Breakdown	**Urban Land**	**7.3%**
	Forested Land	**16.7%**
	Forested Wetland	**31.0%**
	Nonforested Wetland	**0.2%**
	Agricultural Land	**40.8%**
	Scrub/shrub Land	**3.8%**
	Water	**0.1%**
	Barren Land	**0%**
NOTES:	**There are no portions of this watershed listed on the 2010 South Carolina 303(d) List of Impaired Waters.**	
Source: *SC Department of Health and Environmental Control. 2007 Pee Dee River Basin Watershed Water Quality Assessment.*		

Only a very small portion of the Lake Swamp watershed extends into northern Williamsburg County, near Lake City, located in Florence County. US Highway 52 passes through the watershed and has attracted some industry seeking to locate between Florence and Charleston. The only other urbanized area within this watershed that is directly upstream of the Waccamaw region is the City of Johnsonville in Florence County. Otherwise, the Lake Swamp watershed is mostly rural with low growth potential.

Black River Basin, Hydrological Unit: 03040205

The Black River Basin is located in Kershaw, Lee, Sumter, Clarendon, Florence, Williamsburg, and Georgetown Counties, and encompasses 2,060 square miles with geographic regions extending from the Sandhills to the Upper and Lower Coastal Plains and into the Coastal Zone. The Black River Basin encompasses 18 watersheds, approximately 1.3 million acres of which 26.3% is forested land, 35.0% is agricultural land, 4.6% is scrub/shrub land, 27.1% is forested wetland, 6.1% is urban land, 0.4% is nonforested wetland, 0.1% is barren land, and 0.4% is water. The urban land percentage is comprised chiefly of the City of Sumter.

There are approximately 2,143 stream miles, 2,332 acres of lake waters, and 763 acres of estuarine areas in the Black River Basin. The Black River originates near the City of Bishopville and accepts drainage from Rocky Bluff Swamp, the Pocotaligo River, Pudding Swamp, Kingstree Swamp Canal, and Black Mingo Creek before merging with the Great Pee Dee River.

The Table below is a general profile of the Pudding Swamp watershed.

General Profile of the Pudding Swamp Watershed HUC Unit: 03040205-05		
Counties	Lee, Sumter, Clarendon, Williamsburg, Florence	
Watershed Size	119,869 acres	
Surface Waterbody Size	210.1 stream miles/ 175.8 acres of lake waters	
Water Classifications	All waterbodies classified as Freshwaters (FW)	
Main Waterbodies	Pudding Swamp	
Tributaries/ Minor Waterbodies	Hope Swamp, Threemile Branch, Trustless Branch, Horse Branch, Fuller Bay, Cypress Lake, Douglas Swamp, Woods Bay, Cypress Branch, Bushy Branch, Burnt Branch, Rose Creek, Newman Branch, Cain Branch	
Land Use Breakdown	**Urban Land**	**7.9%**
	Forested Land	**15.7%**
	Forested Wetland	**28.3%**
	Nonforested Wetland	**0.3%**
	Agricultural Land	**45.8%**
	Scrub/shrub Land	**1.7%**
	Water	**0.3%**
	Barren Land	**0%**
Source: *SC Department of Health and Environmental Control. 2007 Pee Dee River Basin Watershed Water Quality Assessment.*		

Only a small section of northeast Williamsburg County is located in the downstream portions of the Pudding Swamp watershed. The only developed areas in the upstream portions of the watershed include the Town of Olanta, located in Florence County and Turbeville, located in Clarendon County. Several important roadway corridors intersect the watershed including US Highway 378, US Highway 301, and Interstate 95. The remainder of the watershed is rural, consisting primarily of agricultural and silvilculture land uses. There is no significant development expected in the downstream portions of the Pudding Swamp watershed in Williamsburg County.

The Table below is a general profile of the Hydrological Unit: 03040205-06 segment of the Black River watershed.

General Profile of the Black River Watershed HUC Unit: 03040205-06		
Counties	Lee, Sumter, Clarendon, Williamsburg	
Watershed Size	84,708 acres	
Surface Waterbody Size	190.7 stream miles/ 122.9 acres of lake waters	
Water Classifications	All waterbodies classified as Freshwaters (FW)	
Main Waterbodies	Black River	
Tributaries/ Minor Waterbodies	Mill Branch, Tearcoat Branch, Davis Branch, Pen Branch, Breakfast Branch, Crow Bay, Broad Branch, Conyers Bay, and another Mill Branch.	
Land Use Breakdown	**Urban Land**	**4.1%**
	Forested Land	**23.7%**
	Forested Wetland	**34.8%**
	Nonforested Wetland	**0.3%**
	Agricultural Land	**33.4%**
	Scrub/shrub Land	**3.6%**
	Water	**0.1%**
	Barren Land	**0%**
NOTES:	**There are no portions of this watershed listed on the 2010 South Carolina 303(d) List of Impaired Waters**	
Source: *SC Department of Health and Environmental Control. 2007 Pee Dee River Basin Watershed Water Quality Assessment.*		

The Table below is a general profile of the Hydrological Unit: 03040205-07 segment of the Black River watershed.

General Profile of the Black River Watershed HUC Unit: 03040205-07		
Counties	Florence, Clarendon, Williamsburg	
Watershed Size	209,555 acres	
Surface Waterbody Size	212.1 stream miles/ 137.1 acres of lake waters	
Water Classifications	All waterbodies classified as Freshwaters (FW)	
Main Waterbodies	Black River	
Tributaries/ Minor Waterbodies	Clapp Swamp, Long Branch, Bull Branch, Spring Branch, Kingstree Swamp Canal, Smiths Bay, Findley Bay, Sandy Bay, Laws Swamp, Rocky Ford Swamp, Chaney Swamp, Dickey Swamp, Mulberry Branch, Bennett Swamp, Mill Branch, Pushing Branch, Shanty Branch, Thorntree Swamp, Stony Run Branch, Boggy Swamp, McElroy Branch, Camden Swamp, Ox Swamp, Gumtree Branch	
Land Use Breakdown	**Urban Land**	**5.7%**
	Forested Land	**26.4%**
	Forested Wetland	**29.4%**
	Nonforested Wetland	**0.1%**
	Agricultural Land	**31.8%**
	Scrub/shrub Land	**6.5%**
	Water	**0.1%**
	Barren Land	**0%**
Source: *SC Department of Health and Environmental Control. 2007 Pee Dee River Basin Watershed Water Quality Assessment.*		

Only a small section of the downstream portions of the Black River HUC# 03040205-06 watershed unit traverses northeastern Williamsburg County. This section of the Black River watershed is very rural, however Interstate 95 does intersect this watershed unit for a short distance in Clarendon County. The Black River HUC# 03040205-07 watershed unit encompasses a large portion of Williamsburg County. The county seat of Kingstree is the most heavily populated area within the county and is also accessible from several highways including US Highway 52 and SC Highway SC 261. The Town of Kingstree does have a moderate growth potential as it has recently attracted new industry and has a wastewater treatment plant with enough capacity to accommodate new residential and commercial development. Other populated areas within the watershed include the Town of Greeleyville and the Town of Lane. These communities have seen little growth over the past twenty years and it is not anticipated that they will grow in the near future. The remaining portions of the watershed are largely rural, with agriculture and silviculture being the predominate land use.

Figure 3-6. View of the Black River in Williamsburg County

The Table below is a general profile of the Black Mingo Creek watershed.

General Profile of the Black Mingo Creek Watershed HUC Unit: 03040205-08		
Counties	Georgetown, Williamsburg	
Watershed Size	160,757 acres	
Surface Waterbody Size	219.6 stream miles/ 223.3acres of lake waters	
Water Classifications	All waterbodies classified as Freshwaters (FW)	
Main Waterbodies	Black Mingo Creek	
Tributaries/ Minor Waterbodies	Cedar Swamp, Orr Swamp, Home Swamp, Dry Swamp, The Morass, Pine Island Bay, Parsley Swamp, Whiteoak Swamp, McKnight Swamp, Turkey Creek, Boggy Swamp, Indiantown Swamp, James Branch, Pointer Stump Branch, Wilson Lake, Gully Branch, Headless Creek, Snow Branch, Campbell Swamp, Hickory Nut Branch, Johnson Branch, Walden Branch, Poplar Hill Branch, Caney Branch, Waterman Branch, Hughs Branch, Rome Branch, Burnett Swamp, Jacks Creek, Browns Branch, Squirrel Run, Church Branch, Pittman Branch, Peters Creek, Smith Swamp, Black Steer Swamp, McGinney Creek, Cold Creek, Mingo Swamp, Schoolhouse Branch	
Land Use Breakdown	**Urban Land**	**3.9%**
	Forested Land	**29.2%**
	Forested Wetland	**30.9%**
	Nonforested Wetland	**0.2%**
	Agricultural Land	**29.1%**
	Scrub/shrub Land	**6.5%**
	Water	**0.2%**
	Barren Land	**0%**
Source: *SC Department of Health and Environmental Control. 2007 Pee Dee River Basin Watershed Water Quality Assessment.*		

The Black Mingo Creek watershed is located in a very rural portion of Williamsburg and Georgetown Counties. The largest community in the watershed is the Town of Stuckey, which is not expected to grow significantly in the foreseeable future. The remainder of the watershed is comprised mostly of agriculture and silviculture land uses.

The Table below is a general profile of the Hydrological Unit-03040205-09 segment of the Black River watershed.

General Profile of the Black River Watershed HUC Unit: 03040205-09		
Counties	Williamsburg, Georgetown	
Watershed Size	232,687 acres	
Surface Waterbody Size	354.3 stream miles/ 213.8 acres of lake waters/ 763.3 acres of estuarine areas.	
Water Classifications	All waterbodies are classified as Freshwaters (FW) upstream of the crossing of US Hwy 701. All waterbodies are classified as Class SA (SA) downstream of the US Hwy 701 crossing.	
Main Waterbodies	Black River	
Tributaries/ Minor Waterbodies	Spring Branch, Spring Gully, Jumping Gully, Thompson Swamp, Birch Creek, Dobson Branch, Dobson Bay, Gin Branch, Flat Swamp, Camp Pond Bay, Ricefield Bay, Alligator Bay, Log Branch, Johnsons Swamp, Oakridge Bay, Mill Branch, Murray Swamp, Sportsman Pond, Horse Pen Swamp, Big Dam Swamp, Roper Branch, Sleeper Branch, Cedar Patch Branch, Brightman Swamp, Lester Creek, Puncheon Creek, Indian Hut Swamp, Mill Grove Creek, Lanes Creek, Choppee Creek, Stony Run Creek, Machine Bay, Boheck Creek, Post Foot Branch, Carvers Bay, Big Branch, Millpond Branch, Carvers Bay Creek, Fardick Creek, Peters Creek, Simmons Creek, Guinea Creek, Black Swamp, Post Foot Branch, Sixmile Creek, Gapway Bay, Greens Creek, Prince Creek, Crooked Branch, Inland Branch, Cottage Creek, Longwater Bay	
Land Use Breakdown	**Urban Land**	**3.4%**
	Forested Land	**40.7%**
	Forested Wetland	**28.0%**
	Nonforested Wetland	**1.7%**
	Agricultural Land	**17.4%**
	Scrub/shrub Land	**7.5%**
	Water	**1.2%**
	Barren Land	**0.1%**
Source: *SC Department of Health and Environmental Control. 2007 Pee Dee River Basin Watershed Water Quality Assessment.*		

The HUC Unit# 03040205-09 section of the Black River watershed includes the Town of Andrews. The population of Andrews has remained steady over the last twenty to thirty years and is expected to remain stable in the near future. The watershed is intersected by US Highway 701 and US Highway 521, which could spur some areas of residential and commercial growth. The remainder of this sub-watershed is largely rural consisting primarily of agriculture and silviculture land uses.

Santee River Basin, Hydrological Unit: 03050112

The Santee River Basin encompasses eleven watersheds and 1,279 square miles. The Santee River Basin originates in the Upper Coastal Plain region of South Carolina giving way to the Lower Coastal Plain and the Coastal Zone regions. Of the nearly one million acres, 0.5% is urban land, 11.7% is agricultural land, 12.4% is scrub/shrub land, 0.5% is barren land, 42.5% is forested land, 16.1% is forested wetland, 4.6% is nonforested wetland, and 11.7% is water.

There are a total of 934.4 stream miles in the Santee River Basin, 94,664 acres of lake waters, and 5,275.6 acres of estuarine areas. The Santee River is formed from the confluence of the Congaree and Wateree Rivers and flows through Lake Marion. The river is diverted in lower Lake Marion, and either flows out of the Santee dam to eventually drain into the Atlantic Ocean via the South Santee River and the North Santee River, or is channeled along a 7.5 mile diversion

canal to fill Lake Moultrie. After flowing through the Santee dam, the Santee River is joined by the rediversion canal connecting Lake Moultrie and the lower Santee River.

The Table below is a general profile of the Santee River watershed.

General Profile of the Santee River Watershed HUC Unit: 03050112-01		
Counties	Clarendon, Williamsburg, Berkeley	
Watershed Size	120,857 acres	
Surface Waterbody Size	188.0 stream miles/ 444.6 acres of lakes	
Water Classifications	All waterbodies classified as Freshwaters (FW)	
Main Waterbodies	Santee River	
Tributaries/ Minor Waterbodies	**Tributaries:** Little River, Dead River, Highland Creek, Hicks Branch, Meetinghouse Branch, Bennetts Branch, Doctors Branch, Torkiln Branch, Mill Branch, Mt. Hope Swamp, Hagan Branch, Long Branch, Junkyard Bay, Guise Bay, Little Junkyard Bay, Cypress Bay, Campbell Branch, Walnut Branch, Johns Run. **Oxbow Lakes:** Couturier Lake, Cordes Lake, Solomon Lake, Little Solomon Lake, Wood Lake, Maham Lake	
Land Use Breakdown	**Urban Land**	**0%**
	Forested Land	**45.4%**
	Forested Wetland	**28.8%**
	Non-forested Wetland	**0%**
	Agricultural Land	**14.5%**
	Scrub/shrub Land	**10.2%**
	Water	**0.7%**
	Barren Land	**0.4%**
Source: *SC Department of Health and Environmental Control. 2005 Santee River Basin Watershed Water Quality Assessment.*		

The Table below is a general profile of the South Santee River watershed.

General Profile of the South Santee River Watershed HUC Unit: 03050112-03		
Counties	Williamsburg, Berkeley, Georgetown	
Watershed Size	137,119 acres	
Surface Waterbody Size	180.9 stream miles/ 148.7 acres of lakes	
Water Classifications	All waterbodies classified as Freshwaters (FW)	
Main Waterbodies	Santee River	
Tributaries/ Minor Waterbodies	Wedboo Creek, Meetinghouse Branch, Beauford Branch, Savanna Creek, Byno Creek, Wittee Lake, June Branch, Wittee Branch, Mill Creek, Ferry Lake, Dutart Creek, Echaw Creek, Bark Island Slough, Beaman Branch, Bay Branch, Pole Branch, June Pond, Put-on Branch, Buck Branch, Velvet Branch, Red Bluff Creek.	
Land Use Breakdown	**Urban Land**	**0.1%**
	Forested Land	**63.2%**
	Forested Wetland	**24.4%**
	Non-forested Wetland	**0.0%**
	Agricultural Land	**5.3%**
	Scrub/shrub Land	**5.3%**
	Water	**1.0%**
	Barren Land	**0.4%**
Source: *SC Department of Health and Environmental Control. 2005 Santee River Basin Watershed Water Quality Assessment.*		

The Table below is a general profile of the Wadmacon Creek watershed.

General Profile of the Wadmacon Creek River Watershed HUC Unit: 03050112-04		
Counties	Georgetown, Williamsburg	
Watershed Size	42,927 acres	
Surface Waterbody Size	60.7 stream miles/ 59.7 acres of lakes	
Water Classifications	All waterbodies classified as Freshwaters (FW)	
Main Waterbodies	Wadmacon Creek	
Tributaries/ Minor Waterbodies	Cedar Creek, Long Branch, Brunson Branch	
Land Use Breakdown	**Urban Land**	**0.1%**
	Forested Land	**63.9%**
	Forested Wetland	**17.7%**
	Non-forested Wetlands	**0.0%**
	Agricultural Land	**2.2%**
	Scrub/shrub Land	**9.9%**
	Water	**0.1%**
	Barren Land	**0.9%**
Source: *SC Department of Health and Environmental Control. 2005 Santee River Basin Watershed Water Quality Assessment.*		

The Table below is a general profile of the North Santee River/ South Santee River watershed

General Profile of the North Santee River/ South Santee River Watershed HUC Unit: 03050112-06		
Counties	Georgetown, Charleston	
Watershed Size	79,788 acres	
Surface Waterbody Size	68.5 stream miles/ 657.1 acres of lakes/ 5,266.9 acres of estuarine areas.	
Water Classifications	Both the North and South Santee Rivers are classified as Freshwaters (FW) from their origin to the US Highway 17 crossing, Class SA (SA) from US Highway 17 to 1000 ft. below Atlantic Intracoastal Waterway crossing, and as Outstanding Resource Waters (ORW) from 1000 ft. below the AIWW crossing to the Atlantic Ocean.	
Main Waterbodies	North Santee River, South Santee River, Atlantic Intracoastal Waterway	
Tributaries/ Minor Waterbodies	Chicken Creek, Hampton Creek, Montgomery Creek, Garfish Creek, Sixmile Creek, Pleasant Creek, Collins Creek, Fourmile Creek Canal, Alligator Creek, Sall Creek, Cedar Creek, Pole Branch, Bonny Clabber Creek, White Oak Creek, Nimin Creek, Kinloch Creek, Pleasant Meadow Creek, Bella Creek, Cork Creek, Atchison Creek, Little Duck Creek, Duck Creek, Big Duck Creek, Mosquito Creek, Beach Creek, Cane Creek, and Bird Bank Creek.	
Land Use Breakdown	**Urban Land**	**0%**
	Forested Land	**46.2%**
	Forested Wetland	**4.5%**
	Non-forested Wetlands	**36.8%**
	Agricultural Land	**0.1%**
	Scrub/shrub Land	**1.5%**
	Water	**10.6%**
	Barren Land	**0.3%**
Source: *SC Department of Health and Environmental Control. 2005 Santee River Basin Watershed Water Quality Assessment.*		

The portions of the Santee River Basin that extend into Georgetown and Williamsburg Counties are primarily rural with low growth potential. Much of the downstream sections of this watershed are conserved lands, managed as part of the Francis Marion National Forest, the Yawkey Wildlife Center Heritage Preserve, or the Santee Coastal Wildlife Management Area.

Total Maximum Daily Load Allocations

If a surface waterbody is identified as being impaired on the 303(d) list for one or more water quality parameters, the next course of action is to develop a Total Maximum Daily Load (TMDL) to address the pollutant(s) of concern. A TMDL is a management strategy that identifies all known sources of the pollutant causing the impairment, and assesses the maximum amount of that particular pollutant the impaired waterbody can assimilate and be able to meet water quality standards. When this pollutant load is quantified, an allocation process is established to determine the pollutant discharge limits for all relevant point source dischargers while accounting for all known non-point sources of the pollutant of concern. Once all appropriate control measures are implemented, the water quality is continually monitored and the waterbody is periodically evaluated to see if it is attaining the water quality standards for the pollutant of concern.

Final TMDL limits are established by accounting for Waste Load Allocations (WLA) from all known point source pollutant dischargers, Load Allocations (LA) from all known non-point sources of the pollutant of concern, and by determining a Margin of Safety (MOS) to account for uncertainties in the pollutant loadings entering the watershed.

The equation below represents each category of pollutant loadings that are accounted for in the TMDL development process:

$$\text{TMDL} = \sum \text{Wasteload Allocations} + \sum \text{Load Allocations} + \text{Margin of Safety}$$

Currently there are four TMDLs established in the Waccamaw region. TMDLs are in place in the following locations: Atlantic Intracoastal Waterway/Waccamaw River, Litchfield/Pawleys Island Estuary, Murrells Inlet Estuary, and the Chinners Swamp portion of the Pee Dee River Basin. A description of each of these TMDLs is provided below.

Waccamaw River and the Atlantic Intracoastal Water Way near Myrtle Beach, SC

In 1999, SC DHEC and the US EPA adopted a Biochemical Oxygen Demand TMDL for portions of the Atlantic Intracoastal Waterway and the Waccamaw River in Horry and Georgetown Counties. Both the Waccamaw River and the Atlantic Intracoastal Waterway are tidally influenced with relativity slow stream flow velocities. The Atlantic Intracoastal Waterway has a net northerly flow direction through the Little River Inlet in Horry County. The Waccamaw River has a predominately southerly flow direction towards Winyah Bay in Georgetown. Both of these waterbodies are classified as Freshwaters with a site specific water quality standard for dissolved oxygen (DO). The minimum DO concentration to be maintained in the Waccamaw River is 4.0mg/l. The daily average DO concentration to be maintained in the Atlantic Intracoastal Waterway is 5.0mg/l with a minimum of 4.0 mg/l. SC DHEC water quality data taken at the MD-088, MD-085, MD-127, MD-087, MD-125, MD-089, and MD-091 indicate that DO concentrations regularly fail to meet the established numeric standards during the summer months.

Table 3-1 provides a list of all current DHEC water quality monitoring stations with an approved TMDL that are located in the Waccamaw River and Atlantic Intracoastal Waterway watersheds.

Table 3-1 Monitoring Sites with an Established TMDL for Waccamaw River and Little River/ Atlantic Intracoastal Waterway							
12- Digit HUC Code	Description	Station	County	Use	Cause	Use Support	Approval Date
030402080301	Intracoastal waterway at PT 3 Mi N of Bridge on US 501	MD-085	Horry	AL	DO	Not Supported	07/27/99
030402080301	Intracoastal waterway Just N of Bridge on US 501	MD-087	Horry	AL	DO	Fully Supported	07/27/99
030402080301	Intracoastal waterway 1 Mi S of Bridge on US 501	MD-088	Horry	AL	DO	Not Supported	07/27/99
030402080301	Intracoastal Waterway 2 Mi S of Bridge on US 501	MD-089	Horry	AL	DO	Not Supported	07/27/99
030402080301	Intracoastal Waterway 4 Mi N of Bridge on US 501	MD-091	Horry	AL	DO	Fully Supported	07/27/99
030402080301	Intracoastal Waterway (Little River) on SC9 (US17)	MD-125	Horry	AL	DO	Not Supported	07/27/99
030402061002	Waccamaw River Near Mouth of Bull Ck at Channel Marker 50	MD-137	Horry	AL	DO	Fully Supported	07/29/99
030402061002	Waccamaw River & ICWW 1 MI below Jct at Bucksport Landing	MD-146	Horry	AL	DO	Fully Supported	07/29/99
030402060905	Waccamaw River at US 501 Bypass around Conway	MD-110	Horry	AL	DO	Fully Supported	7/27/99
030402060905	Waccamaw River at Cox's Ferry on County Rd 110	MD-111	Horry	AL	DO	Fully Supported	7/27/99
030402060906	Intracoastal Waterway at SC 544 7.5 Mi SW of Myrtle Beach	MD-127	Horry	AL	DO	Not Supported	7/27/99
030402060907	Waccamaw River at Peachtree	MD-136	Horry	AL	DO	Fully Supported	7/27/99
030402060907	Waccamaw River at Bucksville	MD-145	Horry	AL	DO	Fully Supported	7/27/99
030402060905	Waccamaw River at US 501 Bypass around Conway	MD-110	Horry	AL	DO	Fully Supported	7/27/99

Note: *Abbreviations include AL: Aquatic Life, FC: Fecal Coliform, DO: Dissolved Oxygen.*
Source: *SC Department of Health and Environmental Control, The State of South Carolina's 2010 Integrated Report. Part I: Listing of Impaired Waters.*

It is believed that the dissolved oxygen concentrations are primarily attributable to the natural conditions of this watershed and the surrounding environment. However, Antidegradation Rules outlined in the South Carolina Regulations 61-68 state that under these circumstances only a 0.1mg/l DO deficit is allowed to be attributed to point source dischargers in a river system. An inventory of all point source discharges within the watershed was completed and the entire area of concern was divided into the following four segments: Conway, Bucksport, Hagley, and North Myrtle Beach.

The critical conditions for the wasteload allocation (WLA) of this TMDL was determined using water quality data collected at USGS monitoring stations and from SC DHEC's monitoring site network over a ten year time period from 1988 to 1998. The 25th percentile of all water quality measurements was utilized as the critical condition benchmark for DO. The 75th percentile of all measurements available was utilized as the critical condition benchmark for all other water quality parameters in this river system. These in-stream measurements accounted for pollutant loadings from all sources including point source, non-point source, and conditions attributed to natural sources. The USGS incorporated this baseline data into a water quality model, known as the Branched Lagrangian Transport Model to determine appropriate wasteload allocations in the river system.

Table 3-2 below provides a summary of proposed Ultimate Oxygen Demand (UOD) limits necessary to meet the DO water quality criteria in the Waccamaw River and Intracoastal Waterway.

Table 3-2 Ultimate Oxygen Demand TMDL Permit Limits Summary for Point Source Discharges in the Waccamaw River and Atlantic Intracoastal Waterway

River Segment	Point Source Discharges	1999 Permitted Flow (MGD)	UOD (lbs/day) 1999 Permit Limit	UOD (lbs/day) Proposed TMDL Permit Limit
Conway	City of Conway	3.2	522	303lbs/day distributed amongst all dischargers
	GSWSA Central	1.2	1,351	
	Total	4.4	1,873	
Bucksport	GSWSA Bucksport	0.2	228	84lbs/day
Hagley	GSWSA Schwartz WWTP	12	7,871	8,643lbs/day distributed amongst all dischargers
	Myrtle Beach WWTP	17	13,507	
	GCWSD Murrells Inlet	1	567	
	GCWSD Pawley's Area	2.75	2,275	
	Total	32.75	24,220	
North Myrtle Beach	NMB Ocean Drive	3.4	685	1,638lbs/day distributed amongst all dischargers
	NMB Crescent Beach	2.1	743	
	GSWSA Vereen Plant	2.5	481	
	Total	8.0	1,908	

Source: *South Carolina DHEC, Total Maximum Daily Load Determination for the Waccamaw River and the Atlantic Intracoastal Water Way Near Myrtle Beach, SC. 1999.*

The complete Biological Oxygen Demand TMDL document for the Waccamaw River and Atlantic Intracoastal Waterway watersheds can be accessed at SC DHEC's website at the following link:
http://www.scdhec.gov/environment/water/tmdl/docs/tmdlwac.pdf

Fecal Coliform in Shellfish Waters of the Murrells Inlet Estuary, SC

A Fecal Coliform in Shellfish Waters TMDL for the Murrells Inlet estuary was approved by SC DHEC and US EPA in July 2005. The Murrells Inlet estuary is one of several areas along the coast of South Carolina that is suitable for the cultivation of harvestable shellfish species. Murrells Inlet is one of 25 habitat areas designated as a Shellfish Management Area in the state. The Shellfish Management Area classification number for the Murrells Inlet estuary is MA 04. There is a total of 3,108 acres of suitable shellfish habitat in management area MA 04.

The fecal coliform water quality numeric criteria that are established for Shellfish Harvesting Waters (SFH) are as follows:

- Not to exceed a Most Probable Number (MPN) geometric mean of 14/100ml
- No more than 10 percent of all samples shall exceed an MPN of 43/100ml

Water quality impairments caused by fecal coliform contamination were identified at eight SC DHEC monitoring stations, which led to the placement of these sites on the 2004 South Carolina 303(d) list of impaired waterbodies. A list of all the water quality monitoring stations that are located within the Murrells Inlet TMDL boundaries are provided in **Table 3-3** below.

Table 3-3 Monitoring Sites with an Established TMDL for Murrells Inlet Estuary HUC#:03040208-03							
12- Digit HUC Code	Description	Station	County	Use	Cause	Use Support	Approval Date
030402080310	Main Creek at Mickey Spillane's Home	04-02	Georgetown	SHELLFISH	FC	Not Supported	7/19/05
030402080310	Main Creek SE Side of the Prohibited Area Near Captain Dick's Marina	04-03B	Georgetown	SHELLFISH	FC	Fully Supported	7/19/05
030402080310	Garden City Canal E of Flagg Creek (New 01-01-2004)	04-04A	Georgetown	SHELLFISH	FC	Fully Supported	7/19/05
030402080310	Allston Creek at Weston Flat	04-06	Georgetown	SHELLFISH	FC	Fully Supported	7/19/05
030402080310	Parsonage Creek at Nance's Dock	04-08	Georgetown	SHELLFISH	FC	Not Supported	7/19/05
030402080310	Parsonage Creek at Chicken Farm Ditch	04-16	Georgetown	SHELLFISH	FC	Not Supported	7/19/05
030402080310	Parsonage Creek SW Corner of the Voyager View Marina Prohibited Zone	04-17A	Georgetown	SHELLFISH	FC	Not Supported	7/19/05
030402080310	Main Creek at Oyster Cove	04-23	Georgetown	SHELLFISH	FC	Fully Supported	7/19/05
030402080310	Main Creek at Flagg Creek	04-25	Georgetown	SHELLFISH	FC	Fully Supported	7/19/05
030402080310	Garden City Canal at the "Old Boat Wreck"	04-26	Horry	SHELLFISH	FC	Not Supported	7/19/05
030402080310	Main Creek, Opposite Entrance to Mt. Gilead Canal	04-27	Georgetown	SHELLFISH	FC	Not Supported	7/19/05
030402080310	Oyster Cove, South Branch	04-29	Georgetown	SHELLFISH	FC	Fully Supported	7/19/05
030402080310	Oyster Cove, North Branch	04-30	Georgetown	SHELLFISH	FC	Fully Supported	7/19/05
030402080310	Woodland Creek, 100 Meters East of Mainland	04-31	Georgetown	SHELLFISH	FC	Fully Supported	7/19/05

Note: *Abbreviations include FC: Fecal Coliform.*
Source: *SC Department of Health and Environmental Control, The State of South Carolina's 2010 Integrated Report. Part I: Listing of Impaired Waters.*

The estuary has a linear geography, extending 5.5 nautical miles parallel to the Atlantic Ocean and is less than 1 nautical mile wide. The average main channel depth in the estuary is 4 meters. Salinity within the estuary is generally above 30 parts per thousand (ppt), and freshwater inputs are primarily limited to direct precipitation and associated runoff from nearby areas.

It is known that surrounding land use characteristics can influence fecal coliform loadings in nearby waterbodies. As part of this TMDL, a land use assessment was completed for this 10,250 acre watershed. The watershed is characterized by the following general land use descriptions: forest (31%), open water/beach (27%), urban development (24%), wetlands (16%), and urban/recreation (2%). This TMDL study divided the estuary into eight subwatersheds utilizing the eight impaired monitoring stations as reference points. A more detailed analysis of the surrounding land use characteristics of each subwatershed is provided in **Table 3-4.**

Table 3-4: Land Use Acreage and Percentage Profile of Each Subwatershed in Murrells Inlet Estuary								
Land Use Description	**04-01**	**04-01A**	**04-27**	**04-02**	**04-26**	**04-16**	**04-08**	**04-06**
Barren	41.7 acres	2.8 acres	0.4 acres	0.8 acres	66.8 acres	0.6 acres	0.0 acres	0.6 acres
	3.9%	0.4%	0.1%	0.3%	28.4%	0.3%	0.0%	0.2%
Forest	352.9 acres	148.4 acres	63.0 acres	54.4 acres	1.4 acres	89.8 acres	66.7 acres	89.2 acres
	32.8%	23.2%	20.5%	21.9%	0.6%	39.1%	40.0%	33.6%
Open Water	17.7 acres	60.6 acres	80.0 acres	43.3 acres	63.0 acres	6.2 acres	3.0 acres	65.0 acres
	1.6%	9.5%	26.1%	17.4%	26.7%	2.7%	1.8%	24.5%
Pasture/ hay	14.3 acres	7.2 acres	2.0 acres	0.4 acres	0.8 acres	1.0 acres	0.0 acres	1.0 acres
	1.3%	1.1%	0.6%	0.2%	0.3%	0.4%	0.0%	0.4%
Urban Buildup	487.2 acres	342.8 acres	150.2 acres	137.8 acres	56.4 acres	103.7 acres	84.0 acres	91.2 acres
	45.3%	53.7%	49.1%	55.3%	24.0%	45.3%	50.5%	34.3%
Urban Grasses	59.2 acres	52.8 acres	4.4 acres	2.8 acres	2.6 acres	0.8 acres	2.4 acres	2.0 acres
	5.5%	8.3%	1.4%	1.1%	1.1%	0.3%	1.4%	0.7%
Wetlands	103.5 acres	24.2 acres	6.8 acres	9.3 acres	44.6 acres	27.4 acres	10.5 acres	16.7 acres
	9.6%	3.8%	2.2%	3.8%	18.9%	11.9%	6.3%	6.3%
Totals	1,076.5 acres	638.8 acres	306.8 acres	248.8 acres	235.6 acres	229.5 acres	166.6 acres	265.7 acres

Source: *SC DHEC, Total Maximum Daily Loads for Fecal Coliform in Shellfish Waters of the Murrell's Inlet Estuary, South Carolina (2005).*

The TMDL assessment analyzed water quality samples taken at these monitoring sites over a three year period from September 2001 to August 2004. Water quality data collected at these sites indicate that five sites exceeded both the geometric mean (14/100ml) and the no more than 10% exceedance (43/100ml) fecal coliform standards. The remaining three stations did not meet the requirements for the 10% exceedance standard. A summary of water quality measurements at the eight monitoring stations examined during this TMDL study are provided in **Table 3-5** below:

Table 3-5 Fecal Coliform Sample Data from September 2001-August 2004 at Impaired Monitoring Stations in the Murrells Inlet Estuary						
Water Quality Monitoring Station	**Number of Measurements**	**Geometric Mean**	**# of Samples above 43/100ml**	**% of Samples above 43/100ml**	**Violates Geometric Mean Standard**	**Violates 10% Exceedance Standard**
Main Creek Subwatershed (HUC: 03040207020)						
04-01	36	42.9	19	53%	YES	YES
04-01A	17	30.6	7	41%	YES	YES
04-02	45	7.5	6	13%	NO	YES
04-27	36	13.4	8	22%	NO	YES
Allston Creek Subwatershed (HUC: 03040207020)						
04-06	50	8.7	12	24%	NO	YES
Parsonage Creek Subwatershed (HUC: 03040207020)						
04-08	36	24.4	15	42%	YES	YES
04-16	35	72.7	19	54%	YES	YES
Garden City Canal Subwatershed (HUC: 03040207020)						
04-26	48	14.7	12	25%	YES	YES

Source: *SC DHEC, Total Maximum Daily Loads for Fecal Coliform in Shellfish Waters of the Murrell's Inlet Estuary, South Carolina (2005).*

The primary environmental variables examined in this study were water temperature, tidal stage, total 24-hour precipitation, and salinity levels. The strongest relationship observed was between fecal coliform levels and salinity levels. In-stream fecal coliform levels appear to be highest during times with substantial freshwater inputs and decline when salinity levels increase. This causal relationship indicates that wet weather events are a probable contributor to fecal coliform contamination conditions in the Murrells Inlet estuary. Previous research in the Murrells Inlet area suggests that the fecal coliform pollutant loadings in the estuary are mostly from non-human sources.

A pollutant source assessment was conducted to identify potential sources of fecal coliform loadings to the Murrells Inlet estuary. An inventory of point source dischargers reveals that there are no direct dischargers from wastewater treatment facilities or industrial sites into the Murrells Inlet estuary. Grand Strand Water and Sewer Authority and Georgetown County Water and Sewer District do provide centralized sewer service to residential and commercial properties within this watershed. There are a total of 54 lift stations within the study area that could cause fecal coliform loadings if they fail. However, both management agencies have emergency power sources and a notification system if a station experiences a mechanical malfuntction. Therefore, the centralized sewer system within the watershed is not believed to be a source of fecal coliform pollution.

The Murrells Inlet watershed is located in a designated MS4 NPDES stormwater permitted area. Both Georgetown County and Horry County administer a stormwater management program in their respective jurisdictions. This program is structured to reduce stormwater runoff related pollutant sources to the maximum extent practicable. The Murrells Inlet area does attract substantial boat traffic. There are several marinas within the watershed which provide septage pumpout facilities to their boating customers. Marinas are required to locate outside of an established shellfish harvesting closure zone. Many of the marinas are located in portions of the watershed that are not impaired for fecal coliform so it is doubtful that these marina facilities are significant sources of fecal coliform to the watershed system.

An analysis of potential non-point sources of pollution indicates that there are several potential sources that may contribute to elevated fecal coliform loadings to the Murrells Inlet estuary. Stormwater runoff from urban and suburban areas not covered by the existing MS4 permit is a significant problem in the watershed area. A survey of residential buildings indicate that there are approximately 119 residences adjacent to the Main Creek portion of the estuary that rely on septic systems for onsite wastewater management. Although only two were showing signs of system malfunction, there is a possibility that over time the other septic system units could cause water quality problems if they are not properly maintained. Wildlife are a potential source of fecal coliform loadings in the Murrells Inlet estuary as well. The watershed provides exceptional habitat for waterfowl and also support large populations of other wildlife species such as deer, especially in natural areas including Huntington Beach State Park and Brookgreen Gardens. Domestic pets can be sources of fecal coliform loadings if their waste is not disposed of properly. It is estimated that approximately 273 cats and 240 dogs reside in the watershed. This is an ongoing management issue that requires public awareness and adherence to local ordinances. Finally, although it is not a suspected problem in the Murrells Inlet community, there are a number of recreational boats that navigate through the estuary, therefore a potential for illegal dumping of onboard septage does exist in this watershed. A summary assessment of existing fecal coliform sources and loadings based on water quality samples collected between September 2001 and August 2004 is provided in **Table 3-6**:

Table 3-6 Estimated Daily Average Fecal Coliform Loadings to Impaired Sections of Murrells Inlet Estuary

Impaired System	Nonpoint sources	Septic Systems	Total Loading
Main Creek	1.5x10^12 (cfu/day)	1.4x10^10 (cfu/day)	1.5x10^12 (cfu/day)
Parsonage Creek/ Allston Creek	3.4x10^11 (cfu/day)	0	3.4x10^12 (cfu/day)
Garden City Canal	1.1x10^11 (cfu/day)	0	1.1x10^11 (cfu/day)

***Source**: SC DHEC, Total Maximum Daily Loads for Fecal Coliform in Shellfish Waters of the Murrell's Inlet Estuary, South Carolina (2005)*

The Critical Conditions established for the Murrells Inlet estuary TMDL were defined as periods of low tidal flows, which result in the least amount of dilution for fecal coliform entering the system. The Critical Conditions were therefore set at the 10th percentile value of the daily tidally influenced flows computed during the flow balance. **Table 3-7** provides a summary of the Wasteload Allocation, Load Allocation, and the Margin of Safety for the fecal coliform TMDL in the Murrells Inlet Estuary. For this TMDL, the Wasteload Allocation was set at zero since there are no known point source dischargers in the watershed. The Load Allocation, accounting for non-point sources, varied between the three subwatersheds delineated in the estuary. The Margin of Safety was set at 5% of existing water quality standards meaning the target water quality goals were set at 13.3cfu/mL for the geometric mean and 40.9cfu/mL for the 10% exceedance standard.

Table 3-7 TMDL Summary for the Murrells Inlet Estuary

TMDL (counts/day)	WLA (counts/day)	MS4 WLA (% Reduction)	LA (% Reduction)	Explicit MOS	% Reduction needed to meet geometric mean standard	% Reduction needed to meet 10% excceedance standard
Main Creek Subwatershed (Impaired Stations 04-01, 04-01A, 04-02, 04-27)						
3.8x10^11	N/A	80.4%	80.4%	5%	80.4%	76.5%
Parsonage Creek/ Allston Subwatershed (Impaired Stations 04-08, 04-16, 04-06)						
3.9x10^10	N/A	N/A	81.4%	5%	53.5%	81.4%
Garden City Canal Subwatershed (Impaired Station 04-26)						
4.4x10^10	N/A	N/A	71.4%	5%	0.0%	71.4%

Note: Abbreviations include: WLA- Wasteload Allocation, LA- Load Allocation, MOS- Margin of Safety, N/A- Not Applicable
Source: *SC DHEC, Total Maximum Daily Loads for Fecal Coliform in Shellfish Waters of the Murrells Inlet Estuary, South Carolina (2005)*

The complete Shellfish Waters Fecal Coliform TMDL for the Murrells Inlet estuary can be accessed via SC DHEC's website at the following link: http://www.scdhec.gov/environment/water/tmdl/docs/tmdl_murrells_fc.pdf

Fecal Coliform in Shellfish Waters of the Litchfield- Pawleys Island Estuary, SC

A Fecal Coliform in Shellfish Waters TMDL for the Litchfield- Pawleys Island estuary was approved by SC DHEC and US EPA in April 2005. The Litchfield- Pawleys Island estuary is one of several areas along the coast of South Carolina that is suitable for the cultivation of harvestable shellfish species. The Litchfield- Pawleys Island estuary is one of 25 habitat areas designated as a Shellfish Management Area in the state. The Litchfield- Pawleys Island estuary is located within Shellfish Management Area# MA 04. There is a total of 3,108 acres of suitable shellfish habitat in management area MA 04, of that 1256 acres are part of the Litchfield- Pawleys Island estuary.

The fecal coliform water quality numeric criteria that are established for Shellfish Harvesting Waters (SFH) are as follows:

- Not to exceed a Most Probable Number (MPN) geometric mean of 14/100ml
- No more than 10 percent of all samples shall exceed an MPN of 43/100ml

Water quality impairments caused by fecal coliform contamination were identified at eight SCDHEC monitoring stations, which led to the placement of these sites on the 2004 South Carolina 303(d) list of impaired waterbodies. Many stream segments within this watershed are designated as Shellfish Harvesting Waters which are now subsequently classified as Restricted to harvesting activities due to the presence of elevated levels of fecal coliform bacteria. A list of all the water quality monitoring stations that are located within the Litchfield- Pawleys Island TMDL boundary area are provided in **Table 3-8** below.

Table 3-8 Monitoring Sites with an Established TMDL for the Litchfield-Pawleys Island Estuary HUC#: 03040208-04							
12-digit HUC Code	**Description**	**Station**	**County**	**Use**	**Cause**	**Use Support**	**Approval Date**
030402080401	Clubhouse Creek at Litchfield Boulevard Bridge	04-09	Georgetown	SHELLFISH	FC	Not Supported	7/19/05
030402080401	Shell Avenue and Pawleys Island Creek	04-10	Georgetown	SHELLFISH	FC	Not Supported	7/19/05
030402080401	North Causeway Bridge at Pawleys Island Creek	04-11	Georgetown	SHELLFISH	FC	Fully Supported	7/19/05
030402080401	South Causeway Bridge at Pawleys Island Creek	04-12	Georgetown	SHELLFISH	FC	Not Supported	7/19/05
030402080401	Pawleys Inlet	04-13	Georgetown	SHELLFISH	FC	Not Supported	7/19/05
030402080401	Clubhouse Creek at Dock End of Sportsman Boulevard	04-14	Georgetown	SHELLFISH	FC	Not Supported	7/19/05
030402080401	Clubhouse Creek- First Bend South of Salt Marsh Cove	04-19	Georgetown	SHELLFISH	FC	Not Supported	7/19/05
030402080401	Pawleys Island Sound, Inlet South Boat Landing	04-21	Georgetown	SHELLFISH	FC	Not Supported	7/19/05
030402080403	Midway Inlet	04-15	Georgetown	SHELLFISH	FC	Not Supported	7/19/05

Note: *Abbreviations include FC: Fecal Coliform*
Source: *SC Department of Health and Environmental Control, The State of South Carolina's 2010 Integrated Report. Part I: Listing of Impaired Waters.*

The Litchfield- Pawleys Island estuary has a linear geography, extending 5.5 nautical miles parallel to the Atlantic Ocean and is less than 0.5 nautical mile wide. Water depths within this estuary are generally less than 2.5 meters. Salinity within the estuary is generally above 30 parts per thousand (ppt), and freshwater inputs are primarily limited to direct precipitation and associated runoff from nearby areas.

It is known that surrounding land use characteristics can influence fecal coliform loadings in nearby waterbodies. As part of this TMDL, a land use assessment was completed for this 5,250 acre watershed. Within this area, 1,256 acres are suitable habitat for shellfish production. Approximately 4,886 acres within the watershed drain through one of the eight monitoring stations listed as impaired for the fecal coliform standard. The watershed is characterized by the following general land use descriptions: forest (44%), open water/beach (23%), urban development (9%), wetlands (20%), and urban/recreation (3%).

This TMDL study divided the estuary into eight subwatersheds utilizing the eight impaired monitoring stations as reference points. A more detailed analysis of the surrounding land use characteristics of each subwatershed is provided in **Table 3-9.**

Table 3-9: Land Use Acreage and Percentage Profile of Each Subwatershed in the Litchfield-Pawleys Island Estuary								
Land Use Description	**04-09**	**04-14**	**04-19**	**04-12**	**04-11**	**04-10**	**04-21**	**04-13**
Barren	131.3 acres	19.3 acres	20.1 acres	19.7 acres	19.1 acres	28.4 acres	31.0 acres	35.6 acres
	13.0%	5.9%	5.9%	4.0%	4.1%	6.5%	5.1%	2.9%
Forest	370.6 acres	152.7 acres	93.4 acres	216.3 acres	201.0 acres	166.2 acres	242.3 acres	852.9 acres
	36.8%	46.6%	27.4%	44.5%	43.2%	37.8%	39.6%	70.7%
Open Water	80.2 acres	40.9 acres	70.7 acres	117.4 acres	91.6 acres	103.7 acres	174.2 acres	51.4acres
	7.9%	12.5%	20.8%	24.1%	19.7%	23.6%	28.6%	4.3%
Pasture/ hay	8.7 acres	0.0 acres	0.0 acres	17.5 acres	4.8 acres	3.8 acres	7.2 acres	0.2 acres
	0.9%	0.0%	0.0%	3.6%	1.0%	0.9%	1.2%	0.1%
Urban Buildup	100.5 acres	45.1 acres	29.2 acres	68.3 acres	116.0 acres	52.6 acres	15.3 acres	13.7 acres
	9.9%	13.8%	8.6%	14.0%	24.9%	12.0%	2.5%	1.1%
Urban Grasses	18.7 acres	5.4 acres	0.2 acres	0.4 acres	2.0 acres	2.2 acres	72.9 acres	27.4 acres
	1.8%	1.6%	0.1%	0.1%	0.4%	0.5%	12.0%	2.3%
Wetlands	300.3 acres	64.2 acres	126.9 acres	47.3 acres	31.4 acres	81.8 acres	66.9 acres	225.8 acres
	29.7%	19.6%	37.2%	9.7%	6.7%	18.7%	11.0%	18.7%
Totals	1,010.3 acres	327.6 acres	340.5 acres	486.9 acres	465.9 acres	438.7 acres	609.8 acres	1,207.0 acres
Source: *SC DHEC, Total Maximum Daily Loads for Fecal Coliform in Shellfish Waters of the Litchfield- Pawleys Island Estuary, South Carolina (2005).*								

The TMDL assessment analyzed water quality samples were taken at these monitoring sites over a three year period from September 2001 to August 2004. Water quality data collected at these sites indicate that six sites exceeded both the geometric mean (14/100ml) and the no more than 10% exceedance (43/100ml) fecal coliform standards. The remaining two stations did not meet the requirements for the 10% exceedance standard. A summary of water quality measurements at the eight monitoring stations examined during this TMDL study are provided in **Table 3-10** below:

Table 3-10 Fecal Coliform Sample Data from September 2001-August 2004 at Impaired Monitoring Stations in the Litchfield-Pawleys Island Estuary						
Water Quality Monitoring Station	**Number of Measurements**	**Geometric Mean**	**# of Samples above 43/100ml**	**% of Samples above 43/100ml**	**Violates Geometric Mean Standard**	**Violates 10% Exceedance Standard**
Clubhouse Creek Subwatershed (HUC: 03040207040)						
04-09	36	54.3	21	58%	YES	YES
04-14	36	48.5	19	53%	YES	YES
04-19	36	43.8	15	42%	YES	YES
Pawley's Island Creek Subwatershed (HUC: 03040207040)						
04-12	36	35.5	13	36%	YES	YES
04-11	36	14.2	10	28%	YES	YES
04-10	37	22.3	15	41%	YES	YES
South Pawley's Island Subwatershed (HUC: 03040207040)						
04-21	37	17.3	12	32%	NO	YES
04-13	37	9.5	8	22%	NO	YES
Source: *SC DHEC, Total Maximum Daily Loads for Fecal Coliform in Shellfish Waters of the Litchfield- Pawleys Island Estuary, South Carolina (2005).*						

The primary environmental variables examined in this study were water temperature, tidal stage, total 24-hour precipitation, and salinity levels. The strongest relationship observed was between fecal coliform levels and salinity levels. In-stream fecal coliform levels appear to be highest during times with substantial freshwater inputs and decline when salinity levels increase. This causal relationship indicates that wet weather events are a probable contributor to fecal coliform contamination occurrences in the Litchfield- Pawley's Island estuary.

A pollutant source assessment was conducted to identify potential sources of fecal coliform loadings to the Litchfield-Pawleys Island estuary. An inventory of point source dischargers reveals that there are no direct dischargers from wastewater treatment facilities or industrial sites into the Litchfield- Pawleys Island estuary. There is a NPDES-permitted land application site in the watershed at Inlet Point South Phase II (permit# ND0074616). This facility applies treated effluent to an on-site golf course and does not discharge directly to the estuary. Georgetown County Water and Sewer District provides centralized sewer service to residential and commercial properties within this watershed. There are a total of 37 lift stations within the study area that could cause fecal coliform loadings if they fail. However, Georgetown County Water and Sewer District has emergency power sources and a notification system in place if a station experiences a mechanical malfunction. Therefore, the centralized sewer system within the watershed is not believed to be a source of fecal coliform pollution.

Currently there are no permitted MS4 Stormwater NPDES jurisdictions within the Litchfield- Pawleys Island estuary watershed at this time. However, due to significant growth along the Waccamaw Neck portion of Georgetown County, it is highly probable that portions of the watershed will meet the MS4 Phase II population thresholds at some point in the future. Georgetown County administers a stormwater management program, which is structured to reduce stormwater runoff related pollutant sources to the maximum extent practicable.

An analysis of potential non-point sources of pollution indicates that there are several potential sources that may contribute to elevated fecal coliform loadings in the Litchfield- Pawleys Island estuary. Potential non-point sources include urban and suburban stormwater runoff, individual sewage treatment and disposal systems, wild and domestic animals, and boat traffic. The recent population increase has resulted in the construction of associated development including single and multi-family housing, golf courses, and commercial shopping centers. A 2001 septic system survey conducted in the Litchfield- Pawleys Island estuary indicated that the Marysville community in the Pawleys Island area had numerous malfunctioning septic systems. Although this poses a water quality concern, the Marysville community is located one mile from the estuary and there is a golf course located between the estuary and the Marysville community. Therefore, these failing septic systems are not considered a major contamination threat to the Litchfield- Pawleys Island estuary. Marine and boat related sources of fecal coliform are unlikely due to the absence of marinas within the estuary and the shallow water depth which limits traffic from larger boat vessels.

Wildlife are a significant potential source of fecal coliform loadings in the Litchfield- Pawleys Island estuary. The watershed provides exceptional habitat for shorebirds and also support large populations of other wildlife species such as deer, rabbit, raccoon, and opossum. Domestic pets can be sources of fecal coliform loadings if their waste is not disposed of properly. Based on 1997 residential population figures it is estimated that approximately 138 cats and 122 dogs reside in the watershed. This total pet population suggests that domestic pets are not a major contributor to fecal coliform loadings to the Litchfield-Pawley's Island estuary. However, as local resident populations continue to increase this will be an ongoing management issue that requires public awareness and adherence to local ordinances. Finally, although it is not a suspected problem in the Litchfield- Pawleys Island area, there are a number of recreational boats that navigate through the estuary, therefore a potential for illegal dumping of onboard septage does exist in this watershed.

A summary assessment of existing fecal coliform sources and loadings based on water quality samples collected between September 2001 and August 2004 is provided in **Table 3-11.**

Table 3-11 Estimated Daily Average Fecal Coliform Loadings to Impaired Sections of the Litchfield- Pawleys Island Estuary			
Impaired System	**Nonpoint sources**	**Septic Systems**	**Total Loading**
Clubhouse Creek	4.5x10^11 (cfu/day)	5.0x10^10 (cfu/day)	5.0x10^11 (cfu/day)
Pawley's Island Creek	3.2x10^11 (cfu/day)	2.6x10^10 (cfu/day)	3.4x10^11 (cfu/day)
South Pawley's Island	3.9x10^11 (cfu/day)	1.0x10^10 (cfu/day)	4.9x10^11 (cfu/day)
Source: *SC DHEC, Total Maximum Daily Loads for Fecal Coliform in Shellfish Waters of the Litchfield- Pawley's Island Estuary, South Carolina (2005).*			

The critical conditions established for the Litchfield- Pawleys Island estuary TMDL were defined as periods of low tidal flows, which result in the least amount of dilution for fecal coliform entering the system. The critical conditions were set at the 10th percentile value of the daily tidally influenced flows computed during the flow balance. **Table 3-12** provides a summary of the Wasteload Allocation, Load Allocation, and the Margin of Safety for the fecal coliform TMDL in the Murrells Inlet Estuary. For this TMDL, the Wasteload Allocation was set at zero since there are no point source dischargers in the watershed. The Load Allocation, accounting for non-point sources varied between the three subwatersheds delineated in the estuary and the Margin of Safety was set at 5% of existing water quality standards meaning the target water quality goals were set at 13.3cfu/mL for the geometric mean and 40.9cfu/mL for the 10% exceedance standard.

Table 3-12 TMDL Summary for the Litchfield- Pawleys Island Estuary						
TMDL (counts/day)	**WLA (counts/day)**	**MS4 WLA (% Reduction)**	**LA (% Reduction)**	**Explicit MOS**	**% Reduction needed to meet geometric mean standard**	**% Reduction needed to meet 10% excceedance standard**
Clubhouse Creek Subwatershed (Impaired Stations 04-09, 04-14, 04-15, 04-19)						
3.7x10^10	N/A	N/A	95.2%	5%	71.6%	95.2%
Pawley's Island Creek Subwatershed (Impaired Stations 04-10, 04-11, 04-12)						
3.8x10^10	N/A	N/A	94.2%	5%	40.9%	94.2%
South Pawley's Island (Impaired Station 04-13 and 04-21)						
2.4x10^10	N/A	N/A	70.0%	5%	17.9%	70.04%
Note: Abbreviations include: WLA- Wasteload Allocation, LA- Load Allocation, MOS- Margin of Safety ***Source:*** *SC DHEC, Total Maximum Daily Loads for Fecal Coliform in Shellfish Waters of the Litchfield-Pawleys Island Estuary, South Carolina. 2005*						

The complete Shellfish Waters Fecal Coliform TMDL for the Litchfield-Pawleys Island Estuary can be accessed via SC DHEC's website at the following link: http://www.scdhec.gov/environment/water/tmdl/docs/tmdl_litchfld_pawleys_fc.pdf

Fecal Coliform for Chinners Swamp of the Pee Dee River Basin, SC

In September 2005, SC DHEC and the US EPA approved a fecal coliform bacteria TMDL that covers nine separate subwatersheds within the Pee Dee River Basin in South Carolina. The TMDL was drafted in response to fecal coliform primary contact recreation use water quality standard violations at SC DHEC water quality monitoring sites within these waterbodies. These sites were previously placed on the 2004 South Carolina 303 (d) list of impaired waters. The Chinners Swamp watershed located in Horry County is included in this TMDL document. Information pertaining to the conditions set forth in this TMDL document as it relates to the Chinners Swamp watershed is outlined in the following section.

The Chinners Swamp watershed encompasses an area of 27,264 acres. This part of Horry County is primarily rural with 36 percent of the land cover being forested and 28 percent is described as wooded wetland areas. Agriculture uses are

prevalent and include 4 percent pasture land and 30 percent dedicated to row crops. Only a small fraction of the land area, roughly 2 percent, is utilized for residential or commercial land use purposes. The Town of Aynor is the most well developed area within the watershed. Chinners Swamp is a blackwater system common to the Coastal Plain in South Carolina. Chinners Swamp is part of the larger Brunson Swamp watershed system which encompasses 44,600 acres of total land area in Horry County.

Table 3-13 below provides information regarding the PD-352 monitoring site that is used to measure water quality parameters within the Chinners Swamp watershed. A total of 23 samples taken between 1998 and 2002 were used to evaluate fecal coliform impairment conditions in the Chinners Swamp watershed. Data from these samples was utilized to develop target pollutant reduction goals, which are outlined in the TMDL. Impairments within this watershed were identified based on the percentage of water samples that exceeded 400cfu/100ml. During the sampling period, 17% of the 23 samples at monitoring station PD-352 were greater than the 400cfu/100mL numeric standard, above the ten percent exceedance limit. The maximum concentration of fecal coliform at this monitoring station was 900cfu/100ml.

Table 3-13 Monitoring Sites with an Established TMDL for the Brunson Swamp Watershed HUC#: 03040204-07

12- Digit HUC Code	Description	Station	County	Use	Cause	Use Support	Approval Date
030402040701	Chinners Swamp at Gunters Island Road off S-26-99	PD-352	Horry	REC	FC	Not Supported	09/11/05

Source: *SC Department of Health and Environmental Control, The State of South Carolina's 2010 Integrated Report. Part I: Listing of Impaired Waters.*

As part of the analysis included in the Fecal Coliform TMDL for the Pee Dee River Basin, a source assessment of the pollutant of concern within each subwatershed area was conducted. This source assessment is the basis of determining Wasteload Allocations (WLAs) for point source dischargers and Load Allocations (LAs) for all identified non-point sources of pollution. A Margin of Safety (MOS) is incorporated into the analysis to account for other pollutant sources that are unknown or not easily quantifiable.

Within the Chinners Swamp watershed there are no continuous point sources of pollution such as wastewater treatment facilities or industrial dischargers. This part of Horry County is also not within the boundaries of a MS4 NPDES permitted stormwater program. Therefore this TMDL evaluation assesses non-point sources of fecal coliform bacteria that are common to areas outside of urban areas. The following section provides an overview of the suspected sources of fecal coliform bacteria in the Chinners Swamp watershed.

Wildlife: Fecal coliform bacteria are produced by humans and other warm-blooded animals such as wildlife species including deer, wild turkey, raccoons, and various other bird species. Based on a study conducted by SC Department of Natural Resources, given the land cover characteristics of the Chinners Swamp watershed there are an estimated 30-45 individual deer per square mile throughout this watershed. A typical deer produces roughly 347x10^6 cfu of fecal coliform per day. Based on the estimated deer population in the Chinners Swamp watershed, it is plausible that deer and other wildlife species are significant contributors to the fecal coliform pollutant loading in this watershed.

Livestock Management: Domestic livestock produce significant amounts of fecal coliform and if not properly managed can be a substantial source of fecal coliform pollution in our watersheds. Studies indicate that a single head of cattle produces 100 billion cfu of fecal coliform per day and pigs produce 11 billion cfu of fecal coliform per day. Many agricultural operations utilize manure products as fertilizer for land application purposes. Concentrated Animal Feeding Operations (CAFOs) are regulated under the NPDES program of the federal Clean Water Act. However, there are currently no existing permitted CAFOs within the State of South Carolina. The state maintains a list of Animal Feeding Operations (AFOs), which are permitted under the No Discharge (ND) Land Application permit system in the state.

Currently there are four permitted swine AFOs located in the Chinners Swamp watershed. Of these AFO sites, one is considered large, one is medium, and two are small operations (both of which are presently inactive). The total permitted swine capacity at these four sites is 9,240 individual animals. The total land available for waste disposal at these AFOs is 23 acres.

Cattle production is another common agriculture activity within the Chinners Swamp watershed. Statistics indicate that a typical 1,000 lbs beef cattle produces 11 tons of manure annually and a 1000 lbs dairy cow produces 15 tons of manure each year. The USDA agricultural census data indicates that there are an estimated 399 cattle managed within the watershed producing a total of 10 tons of manure daily. Another challenge to cattle management is restricting direct access to surface waters such as creeks and streams. Cattle can significantly increase fecal coliform loadings to nearby waterbodies if they are allowed access to these water sources. Two effective best management practices that can help reduce fecal coliform pollutant loadings from livestock agricultural areas are to properly dispose of animal waste and to maintain riparian buffers or install fencing adjacent to surface waterbodies on agricultural sites.

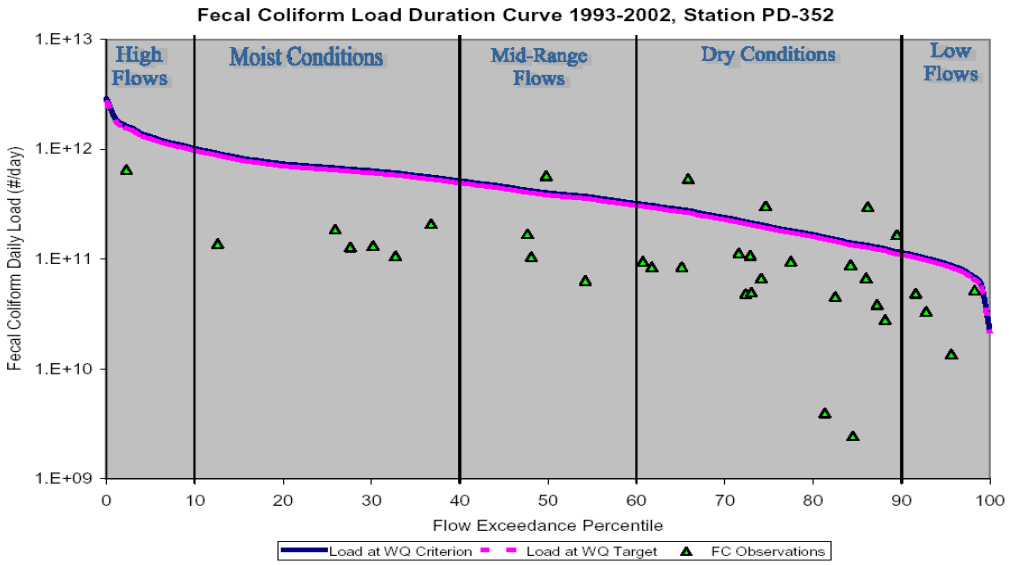
Onsite Wastewater Disposal Systems: Onsite wastewater systems such as septic tanks are commonly utilized in rural areas that are not in close proximity to a centralized sewer system. Improper maintenance of these systems can cause water quality problems by increasing fecal coliform loadings into the environment. US Census figures indicate that there are approximately 941 onsite wastewater systems located within the Chinners Swamp watershed. That equates to roughly three onsite wastewater systems per 100 acres of land area within the watershed. The US Census estimates that ten percent of all existing onsite wastewater systems are malfunctioning. A recent study conducted by SC DHEC suggested that over seven percent of septic systems installed within five years were already beginning to malfunction during high stress conditions such as above normal rainfall. Runoff from properties serviced by onsite wastewater disposal systems are a potential source of fecal coliform loadings in the Chinners Swamp watershed.

Domestic Pets: Another common contributor of non-point sources of fecal coliform pollution are from domestic pets. A typical pet produces 450 million cfu of fecal coliform per day. A widely used figure established by the American Veterinary Medical Association indicates that there is an average of 0.58 dogs and 0.66 cats per household nationally. Extrapolating that figure in Horry County, there are 76,203 dogs and 86,713 cats living in the county.

Although, domestic pets could contribute to the fecal coliform loading in Chinners Swamp, the TMDL document suggests that the biggest pollutant sources of concern within this watershed are from the swine AFOs and onsite wastewater disposal systems. Wildlife and local cattle farms are considered secondary fecal coliform sources of concern in the Chinners Swamp watershed.

TMDL Development Methodology

The fecal coliform TMDL developed for the Pee Dee River Basin utilizes a Load Duration Curve graphic technique to illustrate fecal coliform concentrations in various stream flow conditions. There is a close relationship between flow regime trends and fecal coliform loadings from both point and non-point sources of fecal coliform pollution. This methodology incorporates drainage area ratio-based flow estimates and land use and soil profile information into the water quality model. The Load Duration Curve was also used to estimate and depict nonpoint source loadings during all flow conditions. The Load Duration Curve for the Chinners Swamp watershed is shown below:



A major step in creating the wasteload and load allocations for the TMDL is identifying the hydrological critical conditions that can increase the likelihood of water quality standards violations within a watershed. The rationale is that if water quality standards are attained during instances of critical conditions such as extreme wet weather, then it is anticipated that the standards are met during other normal conditions exhibited in the watershed. The critical condition for the Chinners Swamp watershed are dry conditions as shown in the Load Duration Curve above.

There is a 5 percent margin of safety (MOS) for the normal 400cfu/ 100mL instantaneous water quality criterion established for this TMDL. Therefore the effective targeted water quality standard for the watershed is 380cfu/100mL. As mentioned before there are no distinct point sources of pollutants in this watershed, therefore the Wasteload Allocation (WLA) for this TMDL is set at zero. The existing loading at the PD-352 water quality monitoring station calculated using the 90th percentile is 3.08E+11 per day with a corresponding flow exceedance percentile of 75. This existing loading rate accounts for all known point and non-point sources of pollution in the watershed.

Table 3-14 provides a summary of all of the conditions set forth at the PD-352 water quality monitoring station in the Chinners Swamp watershed to meet the requirement outlined in the Pee Dee River Basin Fecal Coliform TMDL.

Table 3-14 TMDL Summary for the Chinners Swamp Watershed

SCDHEC WQM Station #	WLA's (cfu/day)	MS4 WLA (Percent Reduction)	LA (cfu/day or % reduction)	Margin of Safety	TMDL (cfu/day or % reduction)	Percent Reduction
PD-352	0	NA	1.90E+11	9.98E+09	2.00E+11	39%
Source: *SC DHEC, Total Maximum Daily Loads for Fecal Coliform in Pee Dee River Basin (2005)*						

The complete Fecal Coliform TMDL document for the Pee Dee River Basin can be accessed at the SC DHEC website at the following link: http://www.scdhec.gov/environment/water/tmdl/docs/tmdl_peedee_fc.pdf

This Page Has Been Left Blank Intentionally

Chapter Four: Wastewater Treatment

INTRODUCTION

Wastewater treatment infrastructure is one of the most important long-term investments for all communities and regions. Wastewater treatment facilities help protect water resources by removing pollutant constituents generated by domestic, and industrial waste streams prior to the ultimate disposal to surface waterbodies or land application sites. This chapter provides an overview of the existing wastewater treatment facilities in the Waccamaw region. A summary of future wastewater treatment needs is outlined and innovative technologies and wastewater management strategies that can be applied in the Waccamaw region are explored. In addition, a list of goals and policy recommendations is included to help guide and coordinate long-term regional wastewater planning efforts.

HISTORICAL BACKGROUND

The Waccamaw Regional Council of Governments has helped to facilitate a regional wastewater treatment planning process with SC DHEC and local governments, industries, and public water utility districts since the 1970s. Water quality management strategies have changed substantially since that time due to increased population and land development, upstream water resource use activities, changes in water quality regulations, and the advance of new wastewater treatment technologies. These changes are the main reason why a periodic review and update of the region's water quality management planning efforts is essential.

The first version of the Waccamaw Region Section 208 Water Quality Management Plan laid the groundwork by identifying the main water quality issues of concern in the region, both from point and non-point sources of pollution, and the specific waterbodies that needed a direct and immediate management response. **Table 4-1** below provides a list of the waterbody segments identified as having critical water quality impairment conditions. The original Section 208 Plan provided a level of priority for each identified waterbody.

Table 4-1 1978 Waccamaw Regional 208 Areawide Water Quality Plan-Critical Water Quality Management Areas

Location	Concern	Priority Level
Myrtle Beach Urban Runoff to Ocean	Stormwater dischargers causing high Fecal Coliform levels in the surf zone.	High
AIWW from Bucksport Landing to Little River Inlet	Frequently violating Dissolved Oxygen and Fecal Coliform water quality standards.	High
AIWW from Bucksport Landing to Highway 17 Bridge	Frequently violating Dissolved Oxygen and Fecal Coliform water quality standards.	Medium
Sampit River	Point source dischargers from both industrial sites and municipal facilities.	High
Winyah Bay	Closure of shellfish harvesting areas due to bacteriological contamination.	Medium
Waccamaw River below Conway	Sensitive waterbody due to naturally low Dissolved Oxygen levels, lower pH, and high temperatures associated with extensive floodplain and adjacent swamp habitats.	Low
Black River near Kingstree	Sensitive waterbody due to naturally low Dissolved Oxygen levels, lower pH, and high temperatures associated with extensive floodplain and adjacent swamp habitats.	Low
Murrells Inlet	Closure of shellfish harvesting areas due to bacteriological contamination, likely from septic system failure. Other non-point runoff concerns include elevated heavy metal concentrations.	High

Note: Priority rankings defined as follows: **High-** Should receive current attention. **Medium-** Should receive attention within five years. **Low-** Should receive attention as funds become available after other problems have been resolved.
Source: *1978 Waccamaw Regional 208 Areawide Water Quality Plan.*

Another major accomplishment of the 1978 Waccamaw Region Section 208 Water Quality Management Plan was to designate the appropriate management agency to provide centralized wastewater treatment service to each community within Williamsburg, Georgetown, and Horry Counties. A list of each designated point source management agency can be found in **Chapter 11- Section 208 Program and Administrative Procedures.** This process also included the establishment of the Section 208 planning boundaries for each designated point source management agency. **Exhibit 11.1** is a map with the existing Section 208 planning boundaries for each designated point source management agency.

Since the initial Section 208 Plan was adopted, designated point source management agencies have progressively expanded their wastewater treatment facility capacities to meet increased centralized sewer service demand and to connect residential units utilizing onsite septic systems to the larger regional system. Each management agency has also implemented facility upgrades as necessary to meet new water quality standards and to fulfill requirements established by approved TMDLs in the Waccamaw region. Regional wastewater treatment management efforts have helped address numerous water quality concerns and have had positive impacts on the economy and the overall quality of life for residents and visitors of the Waccamaw region.

Even with the substantial previous investment and regional coordination, there are many water quality issues that still remain today. This emphasizes the reality that water quality management is an ongoing effort. A one-time investment cannot perpetually resolve all water quality concerns. The remainder of this chapter investigates current wastewater treatment methods and evaluates potential strategies that can be employed to ensure that the future water quality of the Waccamaw region is protected and maintained.

EXISTING WASTEWATER TREATMENT RESOURCES

There are numerous wastewater treatment facilities throughout the Waccamaw region. Within each county there are publicly operated wastewater utilities providing centralized sewer service to residents in each community. There are also several industries in each county that discharge treated effluent to nearby surface waters. **Insert 4A** and **Insert 4B** provides a detailed overview of each of the point source discharge facilities located in the Waccamaw region. Information provided includes the location, treatment capacity, and the receiving waterbody of the discharged effluent from each facility. A detailed summary of the effluent limits incorporated into each of the facility's NPDES point source discharge permits is also provided.

WASTEWATER TREATMENT MANAGEMENT ISSUES

The wastewater treatment system consists of several individual stages or components including the expansive sewer line collection network and associated pump stations, each process stage at the wastewater treatment facility, the final effluent disposal method, and the biosolids handling process. Each of these elements requires ongoing management to keep the entire system operating effectively. The following section examines the typical management challenges associated with meeting wastewater service demands at a reasonable cost while ensuring that the facility remains in compliance with the discharge limits set forth in each respective NPDES permit.

Insert 4A- Waccamaw Region Wastewater Treatment Facilities, General Information

Horry County NPDES Wastewater Treatment Facility- General Information

Wastewater Treatment Facility	NPDES Permit #	Location	Type of Wastewater	Receiving Waterbody	Watershed HUC Unit	Quantity (MGD)	Current Average Daily Flow Rate	Notes
AVX Corporation- Conway Plant	SC0048402	2875 Hwy 501 E Conway, SC 29526	Industrial	Socastee Swamp	03040206-09	Monitor and Report	0.023 MGD	
GSWSA/ Loris Wastewater Treatment Facility	SC0025348	Approximately 2,000 feet east of Bayboro Street, adjacent to Plesant Meadow Swamp in Horry County, South Carolina	Municipal	Pleasant Meadow Swamp	03040204-06	0.7 MGD	0.6 MGD	
GSWSA/ Schwartz/ Myrtle Beach Plant	SC0037753	Schwartz: on Freewoods Rd, approximately 1700 ft south of its intersection with Enterprise Road, Horry County, SC; Myrtle Beach: Off of Mr. Joe White Ave, approximately 3000 ft north of the intersection of Mr. Joe White Ave and Hwy 17 bypass	Municipal	Waccamaw River	Schwartz:03040206-10/ Myrtle Beach:03040208-03	Schwartz: 19.35MGD/ Myrtle Beach: 17.0 MGD (expanding to 22.4MGD)	Schwartz: 10.90 MGD Myrtle Beach: 9.29 MGD	1. Over 2.9 GPD of treated wastewater is applied to 4 separate land application sites(GSWSA Turf Farm, Island Green Golf Course, MG Golf and Yacht, Tip Top Tree Farm- ND0078921)2. This wastewater treatment facility treats 24,000 GPD of influent from one industrial site, AVX Corporation in their service area.
GSWSA/ Bucksport WWTF	SC0040886	East of Secondary Road 48 and 1/2 mile northwest of the Waccamaw River in Bucksport	Municipal	Waccamaw River	03040206-10	0.3 MGD	N/A	
GSWSA/ Conway WWTP	SC0021733	New Road, Conway,SC	Municipal	unnamed ditch to Woodland Swamp to Lake Bushy Canal to Wadus Lake to Waccamaw River	03040206-09	4.0 MGD	2.3 MGD	
GSWSA/ George R Vereen WWTP	SC0041696	approximately one mile south of the intersection of SC Highway 90 and Secondary Road 57 in the Wampee Community in Horry County, SC	Municipal	Carolina Bays Wetland System/ Atlantic Intracoastal Waterway	03040208-03	7.0 MGD	3.63 MGD	
GSWSA/ Central Wetlands WWTP	SC0039900	Jackson Bluff Road, west of SC Highway 544 southwest of Conway	Municipal	Riverine Wetlands to Waccamaw River	03040206-09	1.2 MGD Capacity/ 0.616 MGD permitted flow		Currently used as an equalization basin to pretreat and store of influent to the Schwartz WWTP
GSWSA/ Longs WWTP	SC0040878	A point 1/2 mile south of the intersection of SC Highway 9 and 905 in the Longs community in Horry County	Municipal	Waccamaw	3040206-07	0.20 MGD	N/A	
North Myrtle Beach- Crescent Beach	SC0022161	End of 27th Avenue South on Airport property in North Myrtle Beach, SC	Municipal	Atlantic Intracoastal Waterway	03040208-03	2.9 MGD	1.1 MGD	
North Myrtle Beach- Ocean Drive	SC0022152	Intersection of 2nd Avenue South and Bay Street of Hwy 17 in North Myrtle Beach, SC	Municipal	Atlantic Intracoastal Waterway	03040208-03	4.5 MGD	2.0 MGD	
AVX Corporation- Myrtle Beach Plant	SC0047953	801 17th Avenue, Myrtle Beach, SC 29577	Industrial	Withers Swash	03040208-03	Monitor and Report	0.03967 MGD	
Santee Cooper Dolphus Grainger Generating Station	SC0001104	1605 Marina Dr. Conway, SC 29526	Electric Services	Waccamaw River	03040206-09	Monitor and Report	1.425 MGD	

Williamsburg County NPDES Wastewater Treatment Facility- General Information

Wastewater Treatment Facility	NPDES Permit #	Location	Type of Wastewater	Receiving Waterbody	Watershed HUC Unit	Quantity (MGD)	Current Average Daily Flow Rate	Notes
Kingstree Wastewater Treatment Plant	SC0035971	SC Highway #527 by-pass, 0.5 miles south of US Highway #52 in the Town of Kingstree, Williamsburg County	Municipal	Black River	03040205-07	3.5 MGD	2.0132 MGD	
Town of Hemingway	SC0039934	Off of Secondary Road S-45-444, approximately 1 mile north of its intersection with S-45-34, northeast of Hemingway in Williamsburg County	Municipal	Clarks Creek to Pee Dee River	03040207-02	0.45 MGD	0.357 MGD	
Williamsburg Co/Santee River WWTF	SC0048097	US Highway 52 near Heineman, Williamsburg County, South Carolina	Municipal	Santee River	03050112-01	0.6 MGD	0.307 MGD	
Martek Biosciences- Kingstree	SC0003123	1416 N Williamsburg Hwy, Kingstree, SC	Industrial	Unamed Tributary to Broad Swamp and to Black River	03040205-07	Monitor and Report	0.143 MGD	
Town of Greeleyville	ND0077968		Municipal	Dedicated Spray Site, Santee River Watershed	03050112-01	0.036 MGD		
Milliken and Co./ Kingstree Mill	SC0023493	SC Hwy 377, Kingstree/ Williamsburg County, South Carolina	Industrial	Black River	03040205-07	Monitor and Report	0.56 MGD	

Georgetown County NPDES Wastewater Treatment Facility- General Information

Wastewater Treatment Facility	NPDES Permit #	Location	Type of Wastewater	Receiving Waterbody	Watershed HUC Unit	Quantity (MGD)	Current Average Daily Flow Rate	Notes
3V Incorporated	SC0036111	Pennyroyal Road, Georgetown County, South Carolina	Industrial	Sampit River	03040207-01	15.0 MGD	3.86 MGD	
City of Georgetown Sewage Treatment Facility	SC0040029	West Street, Georgetown, SC 29442	Municipal	Sampit River	03040207-01	12.0 MGD	3.9 MGD	Permit conditions require treated effluent to be discharged at the outgoing tide
CWS/White Creek-Lincolnshire	SC0030732	Shady Grove Lane Off Hwy 521, Georgetown, SC 29442	Municipal	Whites Creek to Sampit River	03040207-01	Monitor and Report	0.1335 MGD	
GCWSD/ Debordieu WWTP	SC0048984	Firehouse Lane Georgetown, SC 29440	Municipal	Waccamaw River	03040208-04	0.375 MGD (Nov- Feb), 0.5 MGD (Mar-Oct)	N/A	Land Application site: permit # ND0065668 must be utilized at maximum effluent storage capacity prior to discharge to Waccamaw River.
GCWSD/North Santee WWTP	SC0042439	566 Earl Road, Sampit Area in Georgetown County	Municipal	North Santee River	03050112-06	0.52 MGD	0.0284 MGD	
Georgetown County School District Pleasant Hill Elementary	SC0039101	127 Schoolhouse Road, Hemingway, SC 29554	School Facility	Bosser Swamp to Port Creek to Pee Dee River	03040207-02	0.018 MGD	0.003 MGD	
International Paper Georgetown Mill	SC0000868	700 S. Kaminski St. Georgetown, SC	Industrial	Sampit River to Winyah Bay	03040207-01	Monitor and Report	27.9 MGD	
Simpson Lumber Co. Sampit Lumber Mill	SC0046582	2701 Indian Hut Road, Georgetown, SC 29442	Industrial	Unnamed Tributary to Indian Hunt Swamp to Black River	03040205-09	Monitor and Report		
International Paper/ Santee	SC0042960	5956 Fraser St. Georgetown, SC 29440	Industrial	Unnamed Tributary to Turkey Creek to Sampit River	03040207-01	Monitor and Report		
Georgetown Steel Company, LLC	SC0001431	South Fraser Street, Georgetown, SC	Industrial	Sampit River	03040207-01	Monitor and Report	0.25 MGD (August 2008-July 2009)	
GCWSD/Murrells Inlet Wastewater Treatment Plant	SC0040959	1441 Pond Road, Murrells Inlet, SC	Municipal	Waccamaw River	03040206-10	2.0 MGD	1.015 MGD	
GCWSD/Pawleys Island Wastewater Treatment Plant	SC0039951	456 Clearwater Drive, Pawley's Island, SC 29585	Municipal	Waccamaw River	03040206-10	5.5 MGD	2.15 MGD	
Santee Cooper Winyah Generating Station	SC0022471	661 Steam Plant Dr., Georgetown, SC 29440	Industrial	Sampit River	03040207-01	Monitor and Report		
Trebol USA LLC	SC0001619	641 South Rosemary St. Andrews, SC 29510	Industrial	Black River	03040205-09	Monitor and Report	0.0858 MGD	
Inlet Point South Phase III	ND0074616	Inlet Point Drive, Pawleys Island, SC 29585	Private- Domestic	Dedicated Spray Field	03040208-04	0.014 MGD		

Insert 4B- Waccamaw Region Wastewater Treatment Facilities- NPDES Permit Discharge Limits

Horry County NPDES Wastewater Treatment Facility- Permitted Effluent Limits

Wastewater Treatment Facility	NPDES Permit #	Quantity (MGD)	BOD (lbs/day)	NH3-N (mg/L)	TSS (mg/L)	DO (mg/L)	TRC (mg/L)	pH	Fecal Coliform (#/100ml)	Other Parameters
AVX Corporation- Conway Plant	SC0048402	Monitor and Report	Monitor and Report	Monitor and Report	Monitor and Report	N/A	N/A	6.0- 8.5	N/A	**Trichloroethylene:** 0.30 mg/l monthly Avg., 0.44 mg/l daily max
GSWSA/ Loris Wastewater Treatment Facility	SC0025348	0.7 MGD	76.0lbs monthly Avg.	1.0mg/l summer, 1.78mg/l winter monthly Avg.	45.0mg/l monthly Avg.	6.0 min at all times	0.011mg/l monthly Avg., 0.019mg/l daily max	6.0-8.5	200 monthly avg., 400 daily max	**Cadmium:** 0.002 mg/l monthly Avg., **Copper:** 0.010mg/l monthly Avg., **Lead:** 0.004 mg/l monthly Avg., **Zinc:** 0.18 mg/l monthly Avg.
GSWSA- Schwartz/ Myrtle Beach Plant	SC0037753	Schwartz: 19.6 MGD	Schwartz: 4,014.7 Summer, 5,654.5 Winter monthly Avg.	Schwartz: 15mg/l	Schwartz: 30.0 mg/l	6.0 min at all times	0.5 monthly Avg., 1.0 daily max	6.0-8.5	200 monthly avg., 400 daily max	
GSWSA/ Bucksport WWTF	SC0040886	0.2 MGD	50.0lbs monthly Avg.	20.0mg/l monthly Avg.	90.0mg/l monthly avg., 135.0mg/l daily max	6.0 min at all times	0.5 monthly Avg.	6.0-8.5	200 monthly avg., 400 daily max	
GSWSA/ Conway WWTP	SC0021733	4.0 MGD	334.0lbs monthly Avg.	2.0mg/l monthly Avg.	30.0mg/l monthly Avg.	6.0 min at all times	0.011mg/l monthly Avg., 0.019mg/l daily max	6.0-8.5	200 monthly avg., 400 daily max	**Cadmium:** 0.0029 mg/l monthly Avg., **Copper:** 0.0097 mg/l monthly Avg., **Lead:** 0.0032 mg/l monthly Avg., **Zinc:** 0.16 mg/l daily max
GSWSA/ George R Vereen WWTP	SC0041696	7.0 MGD	334.0lbs monthly Avg.	1.83mg/l summer, 2.0mg/l winter monthly Avg.	30.0mg/l monthly Avg.	6.0 min at all times	0.011mg/l monthly Avg., 0.019mg/l daily max	6.0-8.5	200 monthly avg., 400 daily max	**Cadmium:** 0.0029 mg/l monthly Avg., **Copper:** 0.0097 mg/l monthly Avg., **Lead:** 0.0032 mg/l monthly Avg., **Zinc:** 0.16 mg/l daily max
GSWSA/ Central Wetlands WWTP	SC039900	1.2 MGD Capacity/ 0.616 MGD permitted flow	300.2 lbs monthly Avg.	2.05mg/l summer, 2.09mg/l winter monthly Avg.	90.0mg/l monthly avg., 135.0mg/l daily max	6.0 min at all times	0.011mg/l monthly Avg., 0.019mg/l daily max	6.0-8.5	200 monthly avg., 400 daily max	**Cadmium:** 0.002 mg/l monthly Avg.
GSWSA/ Longs WWTP	SC0040878	0.3 MGD	50.0 lbs monthly Avg.	N/A	90.0mg/l monthly avg., 135.0mg/l daily max	4.0 min at all times	0.2mg/l monthly avg., 0.4mg/l daily max.	6.0-8.5	200 monthly avg., 400 daily max	
North Myrtle Beach- Crescent Beach	SC0022161	2.9 MGD	201lbs monthly Avg.	6.0mg/l monthly Avg.	30.0mg/l monthly Avg.	6.0 min at all times	0.234mg/l monthly Avg, 0.404mg/l daily max	6.0-8.5	200 monthly avg., 400 daily max	**Hardness (As CaCO3):** Monitor and Report. **Lead:** 0.026mg/l monthly Avg. **Phosphorus:** Monitor and Report.
North Myrtle Beach- Ocean Drive	SC0022152	4.5 MGD	311lbs monthly Avg.	2.0mg/l summer, 10.0mg/l winter monthly Avg.	30.0mg/l monthly Avg.	6.0 min at all times	0.234mg/l monthly Avg, 0.404mg/l daily max	6.0-8.5	200 monthly avg., 400 daily max	**Hardness (As CaCO3):** Monitor and Report. **Lead:** 0.026mg/l monthly Avg. **Phosphorus:** Monitor and Report.
AVX Myrtle Beach Plant	SC0047953	Monitor and Report	10mg/l monthly Avg., 20mg/l daily max	N/A	N/A	N/A	N/A	6.5-8.5	N/A	**Methylene Chloride:** 0.005mg/l monthly Avg., 0.01mg/l daily max, **1,2-CIS-Dichloroethylene:** 0.07mg/l monthly Avg., 0.14 mg/l daily max, **Vinyl Chloride:** 0.002 monthly Avg., 0.004 daily max, **Trichloroethylene:** 0.005 monthly Avg., 0.01 daily max, **1,1-Dichloroethylene:** 0.004 monthly Avg., 0.006 daily max.
Santee Cooper Dolphus Grainger Generating Station	SC0001104	Monitor and Report	N/A	N/A	30.0 mg/l monthly, 100mg/l daily max	N/A	N/A	5.0-8.5	N/A	**Winter Temperature:** 95F, **Summer Temperature:** 98F, **Oil and Grease:** 15mg/l monthly Avg., 20mg/l daily max, **Arsenic:** Monitor and Report, **Mercury:** Monitor and Report

Williamsburg County NPDES Wastewater Treatment Facility- Permitted Effluent Limits

Wastewater Treatment Facility	NPDES Permit #	Quantity (MGD)	BOD (lbs/day)	NH3-N (mg/L)	TSS (mg/L)	DO (mg/L)	TRC (mg/L)	pH	Fecal Coliform (#/100ml)	Other Parameters
Kingstree Wastewater Treatment Plant	SC0035971	3.5 MGD	876 monthly Avg.	4.55 summer-4.71 winter monthly Avg.	30 monthly Avg.	5.0 Min at all times	0.025 monthly Avg.	6.0-8.5	200 monthly Avg., 400 daily Max	**Cadmium:** 0.008 mg/l, **Copper:** 0.022mg/l, **Lead:** 0.005mg/l, **Mercury:** 0.0001mg/l
Town of Hemingway	SC0039934	0.45 MGD	169 monthly Avg.	10 summer- 26.13 winter monthly Avg.	90 monthly Avg.	5.0 Min at all times	0.1 monthly Avg.	6.0-8.5	200 monthly Avg., 400 daily Max	
Williamsburg Co/Santee RV WWTF	SC0048097	0.60 MGD	150.1 monthly Avg.	Monitor and Report	90 monthly Avg.	2.0 Min at all times	0.5 monthly Avg.	6.0-8.5	200 monthly Avg., 400 daily Max	
Martek Biosciences- Kingstree	SC0003123									
Town of Greeleyville	ND0077968	0.036 MGD	30mg/l	N/A	90 monthly Avg.	1.0 Min at all times	N/A	6.0-8.5	200 monthly Avg., 400 daily Max	
Milliken and Co./ Kingstree Mill	SC0023493	0.56 MGD	149 winter monthly Avg/ 129 summer monthly Avg	N/A	227 lbs per day	5.0 min	N/A	6.0-8.5	N/A	

Georgetown County NPDES Wastewater Treatment Facility- Permitted Effluent Limits

Wastewater Treatment Facility	NPDES Permit #	Quantity (MGD)	BOD (lbs/day)	NH3-N (mg/L)	TSS (mg/L)	DO (mg/L)	TRC (mg/L)	pH	Fecal Coliform (#/100ml)	Other Parameters
3V Incorporated	SC0036111	15.0 MGD	4.0 mg/l monthly Avg, 8.0mg/l daily max	2.0mg/l monthly Avg., 4.0 mg/l daily max	10mg/l monthly Avg. , 20 mg/L daily max	1.0 min at all times	N/A	6.5-8.5	N/A	**Temperature:** (32C monthly Avg., 35C daily max)
City of Georgetown Sewage Treatment Facility	SC0040029	12.0 MGD	1,001lbs. monthly Avg., 1502lbs daily max.	2.0mg/l monthly Avg., 3.0 mg/l daily max	30mg/l monthly Avg. 45 mg/l daily Max	6.0 min at all times	0.278 mg/l monthly Avg., 0.482 mg/l daily max	6.0-9.0	200 monthly Avg., 400 daily max	**Mercury:** Monitor and report, **Enterococci:** 35/100ml monthly avg. 501/100ml daily max
CWS/White Creek-Lincolnshire	SC0030732	Monitor and Report	6.26lbs monthly Avg., 9.38lbs daily max	4.23 mg/l monthly Avg., 6.35mg/l daily max	30mg/l monthly Avg. 45 mg/l daily Max	6.0 min at all times	0.011 mg/l monthly Avg., 0.019 mg/l daily max	6.5-8.5	200 monthly Avg., 400 daily max	**Copper:** 0.0037 mg/l monthly Avg., 0.0058 mg/l daily max **Lead:** 0.0085 mg/l monthly Avg., 0.22 mg/l daily max
GCW&SD/ Debordieu WWTP (Nov-Feb)	SC0048984	0.375 MGD	94.0lbs monthly Avg., 141lbs weekly Avg.	20.0 mg/l monthly Avg., 30 mg/l daily max	30mg/l monthly Avg. 45 mg/l daily Max	5.0 min at all times	0.5 mg/l monthly Avg., 1.0 mg/l daily max.	6.5-8.5	200 monthly Avg., 400 daily max	**Cadmium, Copper, Lead, Mercury, Zinc:** Monitor and Report
GCW&SD/ Debordieu WWTP (Mar- Oct)	SC0048984	0.5 MGD	125.0 lbs monthly Avg., 188.0lbs weekly Avg.	20.0 mg/l monthly Avg., 30 mg/l daily max	30mg/l monthly Avg. 45 mg/l daily Max	5.0 min at all times	0.5 mg/l monthly Avg., 1.0 mg/l daily max.	6.5-8.5	200 monthly Avg., 400 daily max	**Cadmium, Copper, Lead, Mercury, Zinc:** Monitor and Report
GCW&SD/North Santee WWTP	SC0042439	0.52 MGD	13.0lbsmonthly Avg., 19.5lbs weekly Avg.	N/A	90mg/l monthly Avg. 135 mg/L weekly Avg.	1.0 min at all times	0.5 mg/l monthly Avg., 1.0 mg/l daily max.	6.0-8.5	200 monthly Avg., 400 daily max	**Mercury:** Monitor and report
Georgetown County School District Pleasant Hill Elementary	SC0039101	0.018 MGD	2.0lbs monthly Avg., 3.0lbs daily max	1.13 mg/l monthly Avg., 1.69 mg/l weekly Avg.	30mg/l monthly Avg. 45 mg/l daily Max	5.0 min at all times	0.011 mg/l monthly Avg., 0.019 mg/l daily max	6.0-8.5	200 monthly Avg., 400 daily max	**Cadmium:** 0.00035 mg/l monthly Avg, 0.0019 mg/l daily max **Copper:** 0.0087 mg/l monthly Avg, 0.013 daily max, **Lead:** 0.0032 monthly Avg., **Zinc:** 0.16 monthly Avg.
International Paper Georgetown Mill	SC0000868	Monitor and Report	19,150lbs. winter, 8,900lbs. summer monthly Avg.; 38300lbs winter, 1500lbs, summer daily max	Monitor and Report	54,400 lbs/day monthly Avg., 101,000 lbs daily max	N/A	N/A	6.0-9.0	N/A	**Temperature:** 34C monthly Avg., 36C daily max. **AOX:** Monitor and Report. **2,3,7,8-Tetrachloro-dibenzo p-dioxin:** 27.0 pg/l daily max. **Mercury:** Monitor and Report. **Copper:** 14.9 lbs/day daily max. **Chloroform:** Monitor and Report.
Simpson Lumber Co Sampit Lumber Mill	SC0046582	Monitor and Report	24mg/l monthly Avg, 48 mg/l daily max	2.0 mg/l monthly Avg.	55mg/l monthly Avg., 110 mg/l daily max	5.0 min at all times	N/A	6.0-8.5	N/A	**Temperature:** 90F, **Oil and Grease:** 10 mg/l monthly Avg., 15 mg/l daily max.
International Paper/ Santee	SC0042960	Monitor and Report	N/A	N/A	60mg/l daily max	N/A	N/A	6.5-8.5	N/A	**Manganese, Iron:** Monitor and Report
Georgetown Steel Company, LLC	SC0001431	Monitor and Report	Monitor and Report	Monitor and Report	400 lbs/day monthly Avg., 650 lbs daily max.	N/A	N/A	6.0-9.0	N/A	**Temperature:** 35C winter, 38C summer daily max. **Oil and Grease:** 153 lbs/day monthly Avg., 270 lbs daily max, **Lead:** 0.79 mg/l monthly Avg., 2.14 mg/l daily max. **Zinc:** 1.18 mg/l monthly Avg., 3.21 mg/l daily max. **Hexachlorobenzene:** 0.637 ug/l monthly Avg., 0.921 ug/l daily max.
GCWSD/Murrells Inlet Wastewater Treatment Plant	SC0040959	2.0 MGD	167lbs. monthly Avg.	2.0 mg/l monthly Avg.	30 mg/l monthly Avg.	6.0 min at all times	0.5 mg/l monthly Avg., 1.0 mg/l daily max.	6.0-8.5	200 monthly Avg./ 400 daily max	
GCWSD/ Pawleys Island Wastewater Treatment Plant	SC0039951	5.5 MGD	1000lbs. monthly Avg.	14.5 mg/l summer, 20.0 mg/l winter monthly Avg.	30 mg/l monthly Avg.	6.0 min at all times	0.5 mg/l monthly Avg., 1.0 mg/l daily max.	6.0-8.5	200 monthly Avg./ 400 daily max	
Santee Cooper Winyah Generating Station	SC0022471	Monitor and Report	N/A	N/A	19.5mg/l monthly Avg. 59.9mg/l daily max	N/A	7.5 ug/l monthly Avg., 13.0 ug/l daily max	6.5-8.5	N/A	**Temperature:** 93F, **Selenium:** 71ug/l monthly Avg., 290ug/l daily max, **Nickel:** 8.3ug/l monthly Avg., 75.0ug/l daily max, **Thallium:** 6.3ug/l monthly Avg., 9.2ug/l daily max, **Copper:** 3.7ug/l monthly Avg., 5.8 ug/l daily max, **Manganese:** 100ug/l monthly Avg., 146ug/l daily max.
Trebol USA LLC	SC0001619	Monitor and Report	9.4lbs monthly Avg., 18.8lbs daily max	1.78mg/l monthly Avg., 3.56mg/L daily max	33.8 lbs monthly Avg., 62.8 lbs daily max	6.0 min at all times	N/A	Monitor and Report	N/A	**Temperature:** 90F, **Cadmium, Copper, Iron, Nickel, Zinc:** Monitor and Report
Inlet Point South Phase III	ND0074616	0.014 MGD	45 mg/L	N/A	90 mg/L	2.0 mg/L	N/A	6.0-9.0	200 monthly Avg/ 400 daily max	

Wastewater Collection System Maintenance

In terms of geographic scope, maintaining the collection system is one of the single most challenging aspects of operating a wastewater treatment system. As sewer infrastructure systems age, they can become prone to inflow and infiltration (I/I) problems. Inflow and infiltration is the introduction of groundwater and/or stormwater into the sewer collection system. As I/I volumes increase, the intended design capacity of the sewer lines, pump stations, and treatment facilities becomes diminished. The potential for I/I problems is pronounced in coastal South Carolina, as much of the region has a relatively high groundwater table, especially in the winter and spring months. Another major cause of I/I is the penetration of tree roots into the collection system. Sanitary sewers provide great sources of nutrients for tree root growth, which can result in broken or clogged pipes.

The ultimate cause of concern with high I/I rates is the potential for sanitary sewer overflow (SSO) events. Sanitary sewer overflow events caused by a blocked sewer line can lead to the backup of raw sewage into residential plumbing systems, creating serious public health risks. During significant wet weather events, sewer systems prone to I/I can also cause environmental problems if raw untreated sewage escapes the collection system and enters a nearby waterbody.

Figure 4-1 Example of a Sanitary Sewer Overflow
Courtesy of SC DHEC

Reducing instances of SSO events requires a thorough and comprehensive preventative maintenance plan. One mechanism for minimizing I/I problems and preventing SSO events is to implement a Capacity, Management, Operations, and Maintenance (CMOM) program for each sewer system. A CMOM program is designed to provide a flexible and comprehensive framework to more effectively manage and operate the sewer collection system. The CMOM program provides a means for utilities to establish concrete management goals and establishes a protocol for monitoring progress towards achieving each of the outlined goals. Besides an evaluation of the physical assets of the utility, a thorough CMOM program evaluates a range of considerations including budgeting, the organizational structure and personnel needs of the agency, internal and external communications procedures, interlocal service agreement policies, employee training and safety resource needs. Below is a brief description of some of the critical aspects of a typical CMOM program.

- ***Inspections:*** There are several different types of inspection methods including physical inspection of manholes, smoke testing, dye-water testing, internal pipe evaluation using closed circuit video apparatus, and right of way/ easement general inspection. Together these methods allow managers to detect pipe blockages and leakages, sources of I/I, and the location of unauthorized sewer connections. The main objectives of conducting a collection system inspection are to:
    - Evaluate the physical condition of each of the components of the sewer system.
    - Identify the location and types of defects that may be entry points of inflow and infiltration into the sewer system. It is critical to estimate to the extent possible the volume of I/I entering the collection system.
    - Utilize this inspection information and data to help systematically correct sewer system defects.

- ***Maintenance and Rehabilitation:*** The fundamental objective of instituting a regular maintenance and rehabilitation program is to extend the longevity of the existing wastewater collection system. A maintenance and rehabilitation program responds to the system needs identified during the inspection process. General maintenance activities include the periodic cleaning of all sewers and associated appurtenances such as manholes, pump stations, etc. A rehabilitation program requires more long-term planning and entails the development of a repair schedule based on a priority list of projects and a corresponding budget that meets the current and future maintenance needs of the wastewater collection system. It is also important to select the type of rehabilitation to be performed for each project. New technologies such as pipe bursting and sliplining have enabled utilities to repair and replace sewer lines without having to excavate a trench to access the existing sewer line.

- ***Capacity Certification:*** The purpose of a capacity certification program is to ensure that the proper size sewer pipe is installed to accommodate the anticipated wastewater flows that will be collected within an identified service area. Having an effective tracking mechanism which can measure current wastewater flows and accounts for I/I volumes is essential for making decisions regarding any capacity limitations that might prevent the existing collection system from being able to handle new contributing flows to the wastewater treatment system. As the population of the Waccamaw region continues to grow, this aspect of wastewater collection system maintenance and planning will become increasingly important. Several communities in the Waccamaw region are encouraging more dense development and infill redevelopment patterns which will require increased conveyance capacity within the wastewater treatment collection system.

- ***Sanitary Sewer Overflow Emergency Response Program:*** Even in well maintained wastewater collection systems, there is always a possibility of a SSO event. Some SSO events attributed to vandalism or extreme rainfall events are beyond the control of the sewer utility provider. To minimize the public health and environmental impacts during SSO events, it is important to have an adequate response protocol in place to correct the problem and follow all applicable public notification procedures. These procedures include the investigation of the cause of the SSO, the total volume of the system overflow, an assessment of the affected area including any overflows into surface waterbodies, and a determination of whether to restrict public access to the SSO site.

  On a state level, SC DHEC initiated a public notification program in 2008 to report all Sanitary Sewer Overflow events that exceed 5,000 gallons. The state legislature has recently considered making this a mandatory public notification requirement. A list of SSO events that have occurred in the previous six months is available through SC DHEC's website at: http://www.scdhec.gov/environment/water/sso-psf_display.aspx

Investing in a comprehensive collection system inspection and rehabilitation program is a proactive way to prevent SSO events. The financial benefits of implementing this type of a program include savings from reduced emergency repair overtime and construction costs and a reduced likelihood of facing penalties as a result of regulatory non-compliance.

Fats, Oils, and Grease Management

One of the most costly management challenges of operating a wastewater collection system is cleaning and repairing sewer lines that become clogged due to the accumulation of fats, oils, and grease (FOGs) in the sanitary sewer system. These waste products enter the collection system via residential customers pouring kitchen grease into their sink drains and from commercial restaurant establishments with inadequate grease interception mechanisms. Serious FOG accumulation problems can result in SSO events leading to potentially detrimental public health and environmental impacts. A core element of a FOG management strategy is enhancing public awareness about the proper disposal method of kitchen grease byproducts. In addition, while most sewer utility providers require the installation of grease

traps or interceptors in commercial restaurant facilities, it is imperative that these grease traps be properly maintained. Poorly functioning grease traps can cause undesirable FOG constituents to enter the wastewater collection system.

Another emerging FOG management strategy is to foster an economic incentive to separate the grease collected and recycle it into a reusable byproduct such as soaps or biodiesel. Increasingly, there are new grease rendering service provider companies throughout the state. Typically, they collect grease at area restaurants and convert it to biofuel or another type of reusable byproduct. Some communities provide recognition to local restaurants who participate in this type of recycling program.

Biosolids Disposal

In addition to wastewater effluent, the solids separated during the wastewater treatment process need to be adequately treated prior to final disposal. Biosolids are rich in nutrients and also contain some metals. Therefore they need to be properly handled to minimize impacts to the natural environment. The bacterial content in biosolids byproducts can also pose a threat to public health. Careful measures are taken to reduce pathogen levels prior to final disposal of biosolid waste residuals. Common disposal methods for treated biosolids include disposal to an approved landfill site, diversion to a permitted land application site, incineration of dried biosolids, and recycling the biosolids into a reusable compost byproduct. Depending on the design of the wastewater treatment facility, biosolids management can either be a daily or weekly operational task or in the case of a lagoon type system, biosolids are dredged from the facility and disposed of on a periodic basis, ranging from one to ten years depending on the facility.

Figure 4-2 Land application sites can be permitted to accept biosolids material

Biosolid residuals are classified as either Class A or Class B biosolids depending on the level of treatment and the control measures utilized to reduce pathogen levels. Class A biosolids are treated via composting, pasteurization, heat drying, or by increasing the alkalinity in the biosolids mixture. These techniques reduce pathogen levels to a point that is deemed not to pose any risk of infectious disease transmission through direct contact with the residual material. Class A biosolids can meet additional environmental quality criteria, which would allow the biosolids to be marketed and distributed as a fertilizer product to commercial users and even the general public. Class B biosolids are typically treated via aerobic digestion, anaerobic digestion, air drying, or lime stabilization. These processes effectively reduce the level of pathogens, however final disposal of Class B biosolids are limited to landfill disposal or restricted land application uses.

In addition to reducing pathogen levels in biosolid residuals, wastewater treatment operators must also meet requirements to reduce the attraction of vectors such as insects and rodents. The need for vector reduction measures is more pronounced in Class B biosolids due to the higher levels of pathogen content in the biosolids material. Common methods for reducing vector attraction in biosolids is by either incorporating the biosolids into the soil during land application processes or by elevating the pH levels in the biosolids material. Minimizing moisture levels of stored biosolids is important in maintaining stable pathogen levels in the biosolids material.

Industrial Wastewater Pretreatment Programs

Through the NPDES permit program, industrial facilities also must comply with water quality standards prior to the ultimate discharge of industrial process wastewater into surface waterbodies. Some industrial facilities have onsite wastewater treatment facilities and therefore must meet the effluent discharge limits outlined under their individual NPDES permits. Many other industrial sites rely on the wastewater treatment services provided by the local publicly owned treatment works (POTW). Under these circumstances, agreements between the industrial facility and the

wastewater utility district are outlined within an established industrial pretreatment program. Generally, an industrial facility must institute on-site control measures to minimize the level of pollutants that need to be treated at the POTW.

An industrial pretreatment program is designed to support wastewater utility district service efforts by establishing standards and criteria so that the industrial effluent does not disrupt the operations of the treatment facility. Some types of industrial wastewater can cause disruptions within the treatment system, which can potentially result in the discharge of untreated effluent into local waterways. Pass through is a discharge that exits the POTW into surface waters at concentrations or in quantities that cause a violation of requirements outlined in the facility's NPDES permit. Interference is a discharge that causes operational problems at the treatment plant, also resulting in NPDES permit violations. A pretreatment program enables utility districts to accommodate industrial users while providing safeguards to ensure that they are meeting their own NPDES permit requirements and are fulfilling other operational responsibilities within their service region.

Industrial wastewater pretreatment programs incorporate three levels or categories of standards, which apply to each industrial user depending on their industrial classification and the characteristics of their discharge effluent. The following section provides an overview of each type of standard that is implemented as part of an industrial pretreatment program.

1. Prohibited discharge standards that are mandatory for all industrial users.

- Discharges containing pollutants that create a fire or explosion hazard at the POTW, including waste streams with a closed-cup flashpoint of less than 140 °F (60 °C).
- Discharges containing pollutants causing corrosive structural damage to the treatment plant, but in no case discharges with a pH lower than 5.0, unless the facility is specifically designed to accommodate such discharges.
- Discharges containing pollutants in amounts causing obstruction to the flow in the POTW resulting in interference.
- Discharges of any pollutants released at a flow rate or concentration that will cause interference at the POTW.
- Discharges of effluent at temperatures that will inhibit biological activity in the POTW resulting in interference, but in no case heat in such quantities that the temperature at the treatment plant exceeds 104 °F (40 °C) unless SC DHEC, at the utility district's request, approves alternative temperature limits.
- Discharges of petroleum oil, nonbiodegradable cutting oil, or products of mineral oil origin in amounts that will cause interference or pass through.
- Discharges that result in the presence of toxic gases, vapors, or fumes within the wastewater treatment facility in a quantity that could cause acute worker health and safety problems.
- Discharges of trucked or hauled pollutants, except at discharge points designated by the wastewater treatment service provider.

2. Categorical pretreatment standards

Direct Industrial Dischargers. These sites must comply with effluent limitation guidelines, which are national standards developed by the US EPA on an industry-by-industry basis and implemented through the NPDES permit program. They are intended to represent the greatest pollutant reductions economically achievable for an industry. US EPA analyzes the characteristics of the effluent that is commonly discharged by each industry and then identifies the best available technology that is economically achievable for that industry. Requirements established in the effluent limitations guidelines are based on the performance of that technology.

Indirect Industrial Dischargers. This type of industrial facility discharges wastewaters to a POTW and are regulated through categorical standards based on its industrial classification. Pretreatment standards differ

depending on whether the industrial facility is an existing or new discharge source. Standards for new sources are usually more stringent, because a new industrial site should be able to pursue the installation of the best available demonstrated technology to reduce pollutant concentrations and loads that need to be treated by the POTW.

Table 4-2 provides a list of industries subject to specific categorical pretreatment standards prior to final treatment and discharge at a POTW. A full description of each of the specific requirements within the categorical pretreatment standards can be found in the *Federal Register* under **40 CFR Parts 405-471**.

Table 4-2 Categorical Pretreatment Standards for Indirect Industrial Dischargers	
Aluminum Forming	*Nonferrous Metals Forming and Metal Powders*
Battery Manufacturing	*Nonferrous Metals Manufacturing*
Carbon Black Manufacturing	*Oil and Gas Extraction*
Centralized Waste Treatment	*Organic Chemicals, Plastics, and Synthetic Fibers*
Coil Coating	*Paint Formulating*
Concentrated Animal Feeding Operations (CAFO)	*Paving and Roofing Materials (Tars and Asphalt)*
Copper Forming	*Pesticide Chemicals*
Electrical and Electronic Components	*Petroleum Refining*
Electroplating	*Pharmaceutical Manufacturing*
Fertilizer Manufacturing	*Porcelain Enameling*
Glass Manufacturing	*Pulp, Paper, and Paperboard*
Grain Mills	*Rubber Manufacturing*
Ink Formulating	*Soap and Detergent Manufacturing*
Inorganic Chemicals Manufacturing	*Steam Electric Power Generating*
Iron and Steel Manufacturing	*Timber Products Processing*
Leather Tanning and Finishing	*Transportation Equipment Cleaning*
Metal Finishing	*Waste Combusters*
Metal Molding and Casting	
Source: *US EPA- Introduction to the National Pretreatment Program, June 2011*	

3. **Local limits.** Many wastewater utility providers elect to establish local limits to address the industrial pretreatment needs that are specific to their treatment facilities. Local limits are developed for pollutants that could cause interference, pass through, sludge contamination, or worker health and safety problems if received by the POTW at excessive concentrations or quantities. Below is a list of steps and considerations a utility provider should make when assessing the need to institute local limits as part of their industrial pretreatment program.

   - Conduct a survey to identify all industrial users that might be subject to the pretreatment program.
   - Determine the characteristics and volume of flows contributed to the POTW by each of these industries.
   - Assess which pollutants discharged by each of these industrial sites have a reasonable potential for pass through, interference, or sludge contamination.
   - Determine contributions from other sources, such as residential and commercial customers, to determine the maximum allowable headworks loading (MAHL) from industrial sources. Implement a system to ensure that MAHLs will not be exceeded.
   - Unique circumstances that might require the institution of case-by-case discharge limits.
   - Incorporate standards that promote the utilization of best management practices at industrial sites.
   - Any other prohibitions that have been adopted through local municipal ordinances.

It is important to note that while the inspections, reporting, and other administration tasks of industrial pretreatment programs are generally the responsibility of municipal governments or water utility districts, the program must be

approved by the state. The Water Facilities Permitting Division within the Bureau of Water at SC DHEC is in charge of overseeing local industrial pretreatment programs in South Carolina. The requirements adopted by each wastewater utility provider are incorporated into each facility's NPDES permit. The six minimum elements that must be included in the pretreatment program are:

1. The legal authority to administer and enforce a pretreatment program.
2. Procedures to ensure compliance with the requirements of the pretreatment program.
3. Funding sufficient to administer the program.
4. Local limits on industrial users.
5. An enforcement response plan that outlines how the utility district will investigate and respond to instances of industrial noncompliance.
6. A list of all significant industrial users serviced by the POTW.

As communities throughout the region pursue opportunities to attract new industries, wastewater treatment infrastructure will be a critical determinant in being able to provide the essential services that most industries will need. Administering a comprehensive industrial pretreatment program provides the foundation for future economic development opportunities in the Waccamaw region.

For more information about industrial pretreatment programs in the State of South Carolina visit SC DHEC's website at: http://www.scdhec.gov/environment/water/pretreatpage.htm

Contaminants of Emerging Concern

Recently, water resource managers have become increasingly concerned about the presence of a wide range of contaminants, such as pharmaceuticals, detergents, natural and synthetic hormones, and other chemicals in the aquatic environment. It is believed that many of these contaminants enter the municipal waste stream from bathing, laundry, human waste, and improper disposal of pharmaceutical products through the sanitary sewer system. Two possible serious impacts associated with these contaminants are public health risks associated with the presence of these compounds in local drinking water supplies and the impacts on native fish species in the Waccamaw region.

Presently, most contaminants of emerging concern are not typically regulated or monitored as part of the state's ambient water quality monitoring program. The federal government has begun to conduct several research projects to advance our knowledge on the potential impacts of these contaminants. The research findings of this important water quality issue will likely have significant implications on future water quality management efforts, perhaps including the adoption of new limits on municipal drinking water treatment and wastewater treatment permitting programs.

The United States Geological Survey has been one of the leading federal research entities investigating the ecological impacts of contaminants of emerging concern. A recent USGS study published in 2009 entitled *Widespread Occurrence of Intersex Bass found in U.S. Rivers* produced some important findings related to the impacts of endocrine disrupting compounds on aquatic life. The research was conducted at river sites across the United States, including the Pee Dee River in South Carolina. Researchers collected samples from sixteen fish species to assess the prevalence of intersex characteristics among fish populations in streambodies throughout the country. On a national level, intersex characteristics, such as the presence of immature female eggs in the testes of male fish, were most commonly found in smallmouth bass and largemouth bass. The Pee Dee River site in Bucksport, SC had the highest occurrence of intersex fish in largemouth bass at 91% of all samples collected. Researchers indicate that the correlations between the incidence of intersex characteristics in fish species and the presence of known endocrine disrupting compounds were very sporadic. They concluded that the manifestation of intersex traits varied by location and that it was unlikely that occurrences were due to a single definitive source or human activity. This study raised serious concerns about the impacts of contaminants of emerging concern, and also revealed the need for much further study and research.

The USGS Toxic Substances Hydrology Program has initiated the Emerging Contaminants Project to conduct similar research projects to investigate potential implications of this challenging water quality issue. Research is conducted in several specific focus areas that each aim to assist in the development of appropriate management responses to mitigate potential problems associated with this class of contaminants. An overview of each research area within this program is provided below.

1. ***Analytical methods*** The importance of water quality monitoring is strongly emphasized throughout this plan with a particular focus included in **Chapter Nine, Water Quality Monitoring.** To date, one of the difficulties of having a complete understanding of potential problems attributed to contaminants of emerging concern is a lack of analytical tools to measure the amount of each contaminant present in the environment. Several contaminants of emerging concern can only be detected at trace levels, requiring specialized equipment and a precise monitoring protocol. This research division seeks to advance the analytical capabilities of measuring this class of contaminants in the environment.

2. ***Environmental occurrence*** Field research projects are conducted to determine the location and level of occurrence of various contaminants. Some contaminants might impact groundwater resources, while others could have more detrimental impacts in stream habitats. This research allows water quality managers to pinpoint more specifically where mitigation efforts should be prioritized.

3. ***Sources and source pathways*** Preventing harmful contaminants from entering the environment requires thorough investigation into all the possible sources of each pollutant of concern. Suspected sources of contaminants of emerging concern that are regularly studied by the USGS include wastewater treatment plants, biosolids land application sites, onsite wastewater treatment systems, landfill leachate, and concentrated animal feeding operations. Typical research projects related to pollutant source and source pathways aim to identify and quantify the groups of contaminants that are associated with major pollutant sources and the pathways through which these sources contribute contaminants to the natural environment.

4. ***Transport and fate*** This area of research focuses on understanding the ultimate fate of each contaminant once it is released from its original source into the natural environment. Several factors including biological, chemical, and hydrological processes can influence the level of persistence in the environment or the rate of biological degradation of each contaminant of concern.

5. ***Ecologic effects*** Ultimately the main research objective is to determine whether each contaminant of concern is capable of causing detrimental impacts to the natural environment or poses significant risks to human health. Research is needed to understand the potential effects of both acute and long-term exposure to each group of contaminants. Knowing the ecologic and public health effects of each contaminant allows water resource managers to dedicate and prioritize specific resources to mitigate problems associated with known harmful contaminants.

Each of these specific research efforts has helped to expand our knowledge and understanding about this important area of water quality management. As a whole, each research area is integrated to enable water resource managers to develop the most effective strategy to address all potential issues related to contaminants of emerging concern. It is important for water resource managers in the Waccamaw region, in particular representatives from identified contaminant sources such as wastewater treatment facilities, landfills, land application sites, and concentrated animal feeding operations, to be actively engaged in emerging contaminant research and policy development. Public education and awareness on the proper disposal of sources of these contaminants such as pharmaceuticals and personal care products also needs to be an integral aspect in management efforts to address this water quality issue. Several communities throughout the Wacccamaw region are beginning to organize outreach initiatives such as establishing drop off locations and times to collect and safely dispose unused pharmaceuticals.

More information about the USGS Toxic Substances Hydrology Program can be found online at: http://toxics.usgs.gov/regional/emc/index.html

WASTEWATER TREATMENT MANAGEMENT OPPORTUNITIES

New advancements in wastewater treatment technologies are constantly emerging and becoming increasingly more applicable to a larger number of wastewater treatment facilities throughout the country. As a result, it is likely that there will be many new opportunities to improve the treatment capabilities and energy efficiencies at most wastewater treatment facilities in the Waccamaw region. New wastewater reuse alternatives and biosolids byproducts are also being regularly developed as well, providing several innovative wastewater management strategies to consider implementing in the Waccamaw region. This section discusses some of these opportunities and profiles a few existing programs and technologies that have been developed to help address future wastewater treatment needs and challenges.

US EPA's Sustainable Infrastructure Initiative. This program aims to facilitate the application of innovative water infrastructure technologies and best management practices to ensure that long-term infrastructure needs are adequately being met in communities throughout the United States. As existing water infrastructure facilities are being replaced, rehabilitated, expanded, or upgraded, the US EPA encourages communities to institute sustainable practices that use water efficiently and protect water quality health**.** Under this initiative, US EPA promotes Four Pillars of Sustainable Infrastructure, which are described below.

1. ***Better Management of Water and Wastewater Utilities.*** This aspect of wastewater utility sustainability entails taking a broad look at the facility operations, service provision, and general management of the utility. There are numerous approaches to managing each of these areas, and new practices are being developed regularly to improve the overall efficiency of wastewater treatment systems. Increased access to information resources through the US EPA and other professional organizations has enabled local utilities to learn about initiatives and technologies being utilized throughout the country.

2. ***Rates that Reflect the Full Cost Pricing of Services.*** Drinking water provision and wastewater treatment service entail significant capital and operational costs. Water and wastewater utility pricing should be structured so that the consumer pays the appropriate proportion of costs incurred to finance these services. Pricing is a useful way to encourage the end consumer to place an economic value on water resources and make individual efforts to conserve water. There are several benefits of full cost pricing in addition to meeting the operating expenses of the wastewater utility. Conserving water places less demand on water and wastewater facilities thereby reducing the overall energy costs associated with each respective treatment process.

   There are multiple approaches to developing a pricing scheme that reflects the level of water use relative to the costs of providing the utility services. Below is a brief description of common rate structures.

   - **Increasing block rates.** Increasing block rates or tiered pricing reduces water use by increasing the per-unit charges for water as the amount of water used increases. The first block is charged at a base rate, and subsequent blocks are charged at higher rates.
   - **Time of day pricing.** Higher prices are charged during a utility's peak demand periods. Public awareness of peak demand periods should be heightened regardless of whether pricing is structured based on a time of day approach.
   - **Water surcharges.** A higher rate is imposed for excessive water use. Traditionally, many utilities offered volume discounts for customers, meaning that the more water used, the less per unit of volume charged for the service. This type of pricing mechanism has been proven to discourage water conservation and should be repealed if possible.
   - **Seasonal rates.** Prices are structured based on the historical seasonal water demands, with higher prices usually occurring in the summer months.

3. ***Efficient Water Use***. As water infrastructure ages, leaks within the system can begin to occur more regularly. The US EPA estimates that nationwide 14% of all treated potable water is lost due to leaks and other system

inefficiencies. This approach to sustainable water infrastructure emphasizes the need to implement mechanisms and initiatives that help utilities prevent unnecessary water loss and improve overall water use efficiency. Water use efficiency and conservation helps to minimize the costs associated with treating drinking water and subsequently wastewater. As demands for drinking water increase due to population growth pressures, water efficiency and conservation measures can offset the need for new water supplies and withdrawals.

A comprehensive water efficiency use program must incorporate both supply side and demand side measures. An initial supply side management step in addressing water use efficiency is to detect and account for leaks within the distribution system. This assessment provides the baseline information needed to prioritize service line repair projects in the annual operating budget. Another worthwhile exercise is to develop a water conservation plan for the utility. This is a valuable asset management activity that can help extend the life of water and wastewater infrastructure systems by proactively addressing maintenance needs and reducing operating costs. An additional incentive to developing a water conservation plan is that they are an eligibility requirement for several types of federal loan and grant programs. Water utility providers can also structure water rate pricing so that consumers are encouraged to conserve water. Water conservation efforts on the demand side of water servicing, include the use of water efficient household appliances and products. Public education and awareness regarding the importance of water conservation is also an essential aspect of demand side water use efficiency. Resources to address demand side water conservation challenges are available through US EPA's WaterSense program. More information about the WaterSense program can be found online at: http://www.epa.gov/watersense/index.html

4. ***Watershed Approaches to Protection*** As with other aspects of water quality management, evaluating wastewater infrastructure's role in addressing water quality issues needs to be conducted on a regional watershed level. The main focus is on making sound infrastructure and growth decisions within the context of how water flows through a watershed. This aspect of sustainable infrastructure requires cooperation between multiple agencies to maximize available resources. Specific water utility management strategies that can be implemented to address watershed level concerns include interlocal service agreements between utility districts and local governments, source water protection programs, watershed-based permitting including water quality trading programs, and smart growth principles including land use policies aimed at protecting water resources.

More information about US EPA's Sustainable Water Infrastructure Program can be found online at**:**
http://water.epa.gov/infrastructure/sustain/

Energy Efficiency

Providing wastewater treatment service is an energy intensive process entailing an expansive infrastructure system with multiple components including the collection lines, pump stations, and the treatment plant. Wastewater treatment facilities operate on a continuous basis, therefore even small improvements in energy efficiency can reduce energy costs significantly. As energy rates have fluctuated unpredictably over the past several years, facility managers are seeking economical investments in equipment upgrades, or new operation techniques to minimize energy demand and reduce overall wastewater treatment service costs.

It is estimated that drinking water and wastewater systems account for approximately three to four percent of energy use in the United States. On a local level, drinking water and wastewater plants are typically the largest energy consumers of municipal governments, accounting for thirty to forty percent of total energy consumed. On a positive note, studies estimate that at most drinking water and wastewater treatment plants there are many readily achievable strategies that can reduce total energy use by up to thirty percent. This level of energy use reduction can result in significant financial returns within a short payback period.

To begin the process of implementing an energy reduction strategy, it is important for wastewater service providers to conduct a full-scale energy audit at their facilities. This assessment is the starting point for identifying potential energy

savings opportunities at each facility. From there, facility operators can establish an energy benchmarking plan to progressively implement the recommendations noted in the facility energy audit.

The US EPA's Sustainable Infrastructure Initiative is a central resource to learn more about energy efficiency strategies that are being practiced throughout the country. The following section highlights a wide range of management strategies and technologies that are specifically designed to improve wastewater treatment plant energy efficiencies. More information about this program can be found online at: http://water.epa.gov/infrastructure/sustain/energyefficiency.cfm

Variable Frequency Drives: This technology application can be used as part of the wastewater treatment plant's pumping system. They are designed to adjust motor output speeds to the current wastewater volume thus reducing the need to run pump motors at full power on a continual basis.

Freshwater Consumption Reduction: A number of operation and maintenance activities at wastewater treatment facilities, such as compressor cooler water, tank and belt press washdown, etc. require an onsite potable water source. Using recycled final effluent as a water source for these activities reduces the need for freshwater, which is energy intensive to treat and supply.

Optimize Flow with Controls: Installing flow control technology that can address a variation of low and peak design flows can reduce energy use in a treatment facility. One approach is to have smaller pumps operate for longer times, which conveys flows more consistently than larger pumps which are designed for peak flows.

Manage for Seasonal/ Tourist Peaks: The Waccamaw region experiences a significant increase in water and wastewater utility service demand during the summer tourism season. By using a flexible system design, certain stages of the treatment process such as the aeration system can be reduced during off-peak flow periods. Due to permit restrictions, this management practice is generally only feasible for treatment facilities that have separate and redundant treatment trains. Typically, NPDES discharge permits restrict wastewater treatment operators from taking offline individual components of a single unit wastewater treatment system.

Flexible Sequencing of Basin Use: This management strategy makes use of smaller basins while anticipating the need to place additional basins online as projected flows increase over time. In practice, operating a treatment system near its design capacity is more energy efficient than operating a system with larger size basins that are far below design capacity. Implementing this strategy can be as simple as adding an interior wall to partition an existing tank.

Ultraviolet (UV) Disinfection Options: Many wastewater utility providers are beginning to upgrade their facilities to utilize ultraviolet disinfection instead of chlorination disinfection systems. Ultraviolet systems can be configured in several ways, by adjusting the use of bulbs and setting controls based on flow and transmissivity.

Optimize Aeration System: There are several approaches to achieving energy reduction savings by optimizing the aeration system. Fine bubble aeration, dissolved oxygen monitoring and control, and variable capacity blowers are all applications that can be used to improve aeration efficiencies. Integration of all three applications together can increase efficiencies even further. Savings can also be realized in other phases of the treatment process including biosolids processing.

Figure 4-3 Ultraviolet systems have become a common method of final effluent disinfection.

Biosolids Processing Options: Biosolids management can be an energy intensive process due to the extensive aeration and mixing that is required to control volatile solids and reduce vector attraction. The use of fine bubble diffusers

and variable air-flow rate blowers along with a combination of mixing strategies can help reduce the amount of energy used during the biosolids management process.

WASTEWATER TREATMENT MANAGEMENT GOALS AND POLICY RECOMMENDATIONS

The following section provides a list of goals and policy recommendations to help address the current and future wastewater treatment needs in the Waccamaw region. The intent of these goals is to pursue wastewater treatment strategies that achieve the highest level of treatment possible at a reasonable cost to the general public. Another major goal outlined is to improve energy efficiency in wastewater treatment plant operations and to pursue opportunities for wastewater reuse and the beneficial reuse of biosolids. In addition, an ongoing goal is to serve as many residential and industrial customers as possible and continue to pursue collaborative ways to integrate each community's wastewater infrastructure system into a larger regional framework. All of the following goals may apply to designated point-source management agencies differently depending on the priority of needs for each individual facility.

Goal One: Ensure that the long-term domestic and industrial wastewater treatment service needs are adequately met in the Waccamaw region. ***Recommendations include:***

- Regularly review full-time and seasonal population trends in the Waccamaw region to ensure peak wastewater treatment flows are well within treatment facility capacity limits.
- Encourage each designated point source management agency to collaborate with each other in order to provide the highest level of service throughout the Waccamaw region. In the past, interlocal service agreements have been an effective way to provide critical service coverage between point source management agencies.
- Investigate the use of innovative treatment technologies that reduce pollutant loads to surface waterbodies thereby increasing the assimilative capacity to meet future wastewater treatment service demand.

Goal Two: Extend the centralized sewer system where practical to areas with known septic system problems. ***Recommendations include:***

- Update centralized sewer service maps at least once every five years to determine areas that still rely on septic systems to meet their wastewater treatment needs.
- Enhance coordination between the wastewater treatment providers, county governments, county health departments, and SC DHEC to ensure that existing septic systems are being properly maintained and to implement a strategy to address future septic system problems in an effective and timely manner.
- Utilize regulations and incentives, as appropriate, to encourage homeowners relying on septic systems to connect to the centralized sewer system.

Goal Three: Actively implement strategies to improve the energy efficiency for each wastewater treatment facility and associated collection system in the Waccamaw region. ***Recommendations include:***

- As the wastewater treatment system becomes more regionalized, invest in energy efficient technologies such as variable-frequency drives to offset the increased energy demand associated with the need to pump larger volumes of influent for longer distances.
- Pursue a US Department of Energy wastewater treatment facility audit assessment through the Save Energy Now program. More information can be found online at: http://www1.eere.energy.gov/industry/saveenergynow/

- Utilize ENERGY STAR's Portfolio Manager as a tool to establish an energy benchmarking plan for each wastewater treatment facility. This web-based program allows operators to track energy consumption and identify opportunities for energy use improvements. This program also has a performance rating system that allows operators to compare their facilities with others around the country. More information can be found online at: http://www.energystar.gov/index.cfm?c=evaluate_performanc.bus_portfoliomanager
- Develop public awareness initiatives to promote the conservation and efficient use of water. The less water that is used and ultimately returned to the wastestream, the less energy that is required to meet systemwide treatment demands.
- Assist water and wastewater utility providers to develop a water conservation plan for each of their respective jurisdictions.
- Evaluate the feasibility of developing full-cost pricing structures that reflect the variable levels of water use and the associated expenses incurred to provide water and wastewater utility service. Considerations should be made based on water use trends typical to the Waccamaw region, including seasonal variations due to tourist population, climate, etc.

Goal Four: Evaluate problems associated with inflow/infiltration in each POTW collection system in the Waccamaw region and minimize the occurrences of sanitary sewer overflow events in the region. ***Recommendations include:***

- Utilize US EPA's Sanitary Sewer Overflow Analysis and Planning Toolbox to perform a rainfall derived infiltration and inflow assessment for each sewershed in the Waccamaw Region. This analysis can help designated point-source agencies determine the quantity and source of I/I problems within the sewer network. This enables wastewater utility managers to prioritize specific areas within their sewer line network for sewer rehabilitation or implement other targeted I/I mitigation measures. More information can be found online at: http://www.epa.gov/nrmrl/wswrd/wq/models/ssoap/
- Develop and maintain a comprehensive sanitary sewer CMOM (capacity, management, operations, and maintenance) program for each of the designated point source management agencies in the Waccamaw region.
- Encourage each designated point source agency to fully participate in SC DHEC's sanitary sewer overflow event public notification program.

Goal Five: Develop innovative and cost efficient ways to dispose biosolids from wastewater treatment processes safely and with minimal impacts to the natural environment ***Recommendations include:***

- Assess the feasibility of upgrading wastewater treatment facilities that currently produce Class B biosolids to advanced technologies capable of producing Class A biosolids. Also assess the feasibility of establishing regional biosolids handling facilities, to increase the economies of scale to meet the biosolids disposal needs for several facilities concurrently.
- Enhance public awareness about biosolids byproducts that are available for home landscaping purposes. Strive to expand market for biosolids byproducts as an economically feasible approach to biosolids disposal.
- Participate in initiatives such as the National Biosolids Partnership which serves as a clearinghouse and information resource on effective biosolids management practices. More information can be found online at: http://www.wef.org/biosolids

Goal Six: Work with local governments to develop utility concurrency policies which would provide incentives for new development to be served by the existing wastewater treatment collection system. This type of policy should be aimed to encourage infill development and increase urban densities in and near downtown areas. ***Recommendations include:***

- Identify areas within each community that are targeted for infill or high density development and determine whether the existing collection system has the available capacity to meet long-term service needs.
- Assess the benefits and feasibility of instituting a capacity certification program in designated areas targeted for infill development or high density development.

Goal Seven: Develop and expand initiatives to prevent FOG byproducts from entering the sanitary sewer system. ***Recommendations include:***

- Conduct a thorough assessment of issues related to improper FOG byproduct disposal in the sanitary sewer and stormwater collection system in our region. The assessment should include a market evaluation of potential end users of reusable FOG byproducts within the area.
- Provide training workshops to stormwater managers, wastewater treatment providers, and local restaurant owners regarding issues related to FOG byproduct disposal. Workshops should focus on any initiative that may be developed to improve the enforcement of illicit discharge of FOG byproducts, expand grease rendering programming, enhance public awareness, etc.
- Review municipal sewer use ordinances and assess the need to incorporate regulations pertaining to the installation and maintenance of grease interceptors at local restaurant establishments and other known sources of FOG disposal.
- Increase awareness among area restaurants about grease rendering services in the State of South Carolina. Expand public recognition initiatives to restaurants that participate in grease byproduct recycling programs.
- Enhance public awareness efforts about proper grease disposal through mechanisms such as wastewater utility websites, periodic monthly bill inserts, etc.

Goal Eight: Continue to advance local knowledge about the potential impacts of the presence of contaminants of emerging concern in the aquatic environment. Develop appropriate management strategies to address this water quality issue based on detailed scientific understanding of the public health and environmental impacts attributed to contaminants of emerging concern in the Waccamaw region. ***Recommendations include:***

- Utilize new analytical methods to detect contaminants of emerging concern in the local environment and in waste streams as they are developed.
- Actively review management recommendations provided by the USGS and other agencies/institutions based on findings from their ongoing research projects and evaluate their relevance and applicability to the Waccamaw region.
- Develop public awareness initiatives that explains the problems associated with improper disposal of pharmaceuticals and other household products.

This Page Has Been Left Blank Intentionally

Chapter Five: Septic System Management

INTRODUCTION

A common method of treating wastewater is the utilization of on-site wastewater treatment systems, including residential septic tanks. Traditionally, these types of systems have been installed in rural areas, where access to the centralized sewer system is not readily available. Although these systems provide alternatives to large scale public wastewater treatment facilities, there are several management issues including the suitability of installing on-site wastewater treatment systems in certain locations and the typical long-term maintenance needs of these types of systems. This chapter focuses on the use of on-site wastewater treatment systems in the Waccamaw region. Concerns related to public health and environmental issues are assessed. Comprehensive management strategies related to on-site wastewater treatment systems are outlined and a set of policy recommendations is provided.

PUBLIC HEALTH AND ENVIRONMENTAL CONCERNS

Wastewater has a number of harmful constituents that can adversely affect human health and cause environmental contamination and degradation if not properly treated. The most prevalent human health concern associated with domestic wastewater is the presence of pathogenic bacteria. Exposure to pathogenic bacteria can cause minor intestinal illnesses such as diarrhea, as well as other waterborne diseases such as *Giardiasis* and *Cryptosporidiosis.* Septic system failures can result in the contamination of nearby groundwater sources, which can be a pathway for human exposure if groundwater supplies are utilized as the local drinking water supply. Direct physical contact is another means of transmitting disease-causing microorganisms. Failing septic systems can lead to direct exposure to elevated levels of pathogenic bacteria, posing similar risks of contracting water-borne diseases. In addition, several stream segments within the Waccamaw region are listed as impaired due to non-attainment of the fecal coliform standard. A probable source of many of these impairments is from failing septic systems. Watershed assessments, such as Total Maximum Daily Loads for fecal coliform, must include an investigation of whether failing septic systems may be a possible cause of these impairments.

As a coastal area, the Waccamaw region faces added environmental threats caused by failing septic systems. Coastal areas typically have a shallow water table which makes it highly restrictive to use septic systems as a wastewater treatment practice. South Carolina state law requires a minimum 6-inch distance between the seasonal high water table and the bottom of the septic system drainfield. The Waccamaw region is also characterized by the presence of sandy soils, which in some circumstances allows wastewater to infiltrate through the soil substrate without being fully treated. Our local coastal inlets are critical habitat for shellfish harvesting areas, such as oysters. As filter feeders, shellfish can become contaminated by the presence of pathogenic bacteria. Failing septic systems can be a source of pathogenic bacteria due to non-point runoff into nearby shellfish habitat areas. Malfunctioning septic systems also release excessive amounts of nitrates and phosphates into the environment, degrading the water quality of nearby streams and rivers. These nutrients can cause algal blooms resulting in dissolved oxygen deficits leading to the loss of habitat for aquatic life.

In determining the suitability of installing an on-site wastewater treatment system, several considerations must be made. First, the on-site soil type is an important limiting factor. Each soil type has varying capabilities of filtration and percolation. **Appendix E** describes the soil types and characteristics that are present in the Waccamaw region and provides a survey map for each county. The tables provided in **Appendix E** also include general guidance on the suitability of each soil type for siting septic systems. In addition, the depth of the water table is a common constraint for the placement of septic systems. Physiographically, the Waccamaw region is located in the Coastal Plain region of the

southeastern United States. This area is known for having shallow depths to the groundwater table. The water table in this region also varies seasonally, requiring site design criteria to be specified for the zone of saturation.

FUTURE SEPTIC SYSTEM MANAGEMENT NEEDS

To prevent or reduce the environmental and public health impacts associated with septic systems, multiple management strategies must be implemented. Most importantly, installing septic systems in areas that are not suitable for on-site waste disposal systems should be avoided. This requires an on-site assessment of the soil conditions, water table levels, and the presence of nearby sensitive natural resources. Septic system functionality is highly dependent on the site conditions, therefore following an approach that prohibits septic system installation in poorly suited areas can prevent costly problems in the future. Another important management strategy is to ensure that homeowners relying on a septic system are aware of how these systems work and the regular maintenance that needs to be performed in order to keep the system functioning properly. Finally, remediation of failing septic systems is sometimes the only remaining option in areas that have chronic incidences of septic system problems. Planning the extension of centralized sewer to serve these communities is an ongoing task in the Waccamaw region. This section provides more detail on each of these approaches to septic system management.

Homeowner Awareness and Education

Properly maintaining a septic system is an extremely important homeowner responsibility for residents relying on this type of on-site waste management system. Prospective rural property owners need to do their due diligence in evaluating land parcels on which they plan to build residential dwelling units. SC DHEC can perform a site evaluation that delineates all required septic system setbacks including:

- Buildings- 5 feet
- Property lines- 5 feet
- Private well- 75 feet (changed from 50ft in Jan 2009. Existing sites can maintain this setback distance)
- Public well- 100 feet
- Surface waters- 75 feet
- Drainage ditch- 25 feet (changed from 50ft in Jan 2009. Existing sites can maintain this setback distance)

The site evaluation can also identify other site conditions that would make the installation of a residential septic system unfeasible, including the presence of wetlands, poor surface drainage, and flooding frequency of nearby streams and rivers. It is important to recognize areas that are not suitable for the placement of septic systems. This will minimize future public health and environmental concerns and avoid long-term homeowner costs associated with managing these types of systems.

Many homeowners who occupy previously owned property do not know precisely where the septic system is located on their property. This information is essential in order to conduct routine homeowner assessments and to minimize activities requiring heavy equipment on or near the septic system and drainfield. This may cause physical damage or reduce the functionality of the on-site system. SC DHEC maintains permit records for septic systems of residences that were built within the last twenty years. A licensed professional septic system inspector can also identify the location of the septic system on private properties.

The best course of action to ensure the long-term functionality of a septic system is to routinely inspect the septic system every two years and have the system pumped out every three to five years. Also, the proper use of household water can minimize overloading and stress on the system. Water conservation devices such as low-flow toilets, faucets, and

showerheads can ensure that the amount of wastewater flowing through the septic system and drainfield does not approach or exceed the design capacity of the on-site system. Extra care should be taken to avoid the disposal of trash, food waste such as coffee grinds and grease, and household chemical products through the septic system. This can impact the physical and biological integrity of the on-site waste management unit. Regular care can prevent unforeseen septic system failures and backups. Finally, homeowners should be aware that maintaining their onsite septic system is their legal responsibility. Residents who live nearby can file a complaint if excessive odor or other public health concerns can be linked to a failed septic system. SC DHEC can issue a notice of violation and pursue legal action to correct the problem.

SC DHEC- Priority List of Environmentally Distressed Communities

SC DHEC's Bureau of Environmental Health maintains a statewide assessment of communities that are in need of sewer facilities. Surveys are conducted to determine whether existing on-site septic systems are adequately functioning. The survey consists of several criteria that are applied to a formula that is based on the percentage of residential dwellings within the assessed community that are experiencing on-site wastewater management issues. The survey findings are utilized to develop a priority list of communities that are considered environmentally distressed. Several communities within the Waccamaw region are included on SC DHEC's Priority List of Environmentally Distressed Communities.

Ongoing efforts by the local water and sewer utility providers have led to significant progress in addressing the sewer needs of communities located in the Waccamaw region. Many communities that were listed in the June 22, 1999 Sewer Needs Ranking list have been removed due to the extension of central sewer lines to service these areas. Communities that have been delisted as Environmentally Distressed Communities are included in **Table 5-1.**

Table 5-1: Communities Removed from the Priority List of Environmentally Distressed Communities since 1999.

Community	County
Choppee	Georgetown
Pennyroyal Rd.	Georgetown
Bennettown	Horry
Cedar Branch	Horry
Cochrantown	Horry
Pennyroyal Village	Horry
Woodland	Georgetown
Rock Bluff	Williamsburg
Watson's Riverside	Horry
Aynor	Horry

Source: *SC DHEC, 2010 Priority List of Environmentally Distressed Communities for Sewer Needs.*

Table 5-2 includes the most recent updated Priority List of Environmentally Distressed Communities for Sewer Needs issued by SC DHEC on June 28, 2010.

Table 5-2 SC DHEC Priority List of Environmentally Distressed Communities for Sewer Needs				
Ranking	**Community**	**County**	**# Dwellings Surveyed**	**Index Per Dwelling**
2	Annie Village	Georgetown	51	3.69
3	Greeleyville	Williamsburg	222	3.55
5	Lane	Williamsburg	228	3.31
6	Plantersville	Georgetown	128	3.23
10	Sandridge	Williamsburg	56	3.14
11	Beulah Road	Williamsburg	54	3.06
13	Sandy Island	Georgetown	25	2.96
14	Muddy Creek	Williamsburg	23	2.96
17	St. Paul's	Georgetown	278	2.86
18	Rock Bluff	Williamsburg	20	2.8
21	Brunson Crossroad	Williamsburg	173	2.77
23	Gausetown	Williamsburg	317	2.7
24	Nesmith- Morrisville	Williamsburg	574	2.67
25	Brooksville	Horry	83	2.65
26	Little River Road	Horry	45	2.62
27	Andrews	Georgetown	50	2.58
28	Shaw Corner	Williamsburg	36	2.58
29	Hebron	Williamsburg	125	2.57
31	Bloomingvale	Williamsburg	456	2.51
32	Red Road	Williamsburg	118	2.5
35	Intracoastal Waterway	Horry	18	2.44
37	Allentown	Horry	134	2.28
38	Trio	Williamsburg	315	2.25
40	White Oak	Williamsburg	117	2.21
46	St. Lawrence	Williamsburg	370	2.07
48	Poplar	Horry	565	1.99
50	Pawley's Island SC	Georgetown	299	1.99
54	South Williamsburg	Williamsburg	392	1.95
61	Sampit	Georgetown	273	1.75
69	Flagpatch	Horry	109	1.6
79	Sandridge	Horry	80	1.3
83	Briarcliffe	Horry	62	1.13
Source: *SC DHEC, 2010 Priority List of Environmentally Distressed Communities for Sewer Needs*				

It is apparent that community sewer service needs will be a prevalent concern for the foreseeable future in the Waccamaw region. The periodic community sewer need surveys are important for establishing the initial determination of areas that are vulnerable to public health and environmental problems due to poorly functioning on-site wastewater systems. Communication is vital so that homeowners are aware of the risks associated with on-site wastewater disposal problems. A process can then begin to explore the most effective and economically feasible wastewater treatment alternative for each affected community. Funding mechanisms can then be pursued to initiate necessary capital improvement projects and homeowner awareness initiatives.

SEPTIC SYSTEM GOALS AND RECOMMENDATIONS

The following section provides a list of goals and corresponding recommendations with respect to managing existing and future septic system issues in the Waccamaw region. Some of these goals highlight the public outreach needs to ensure that homeowners are aware of their responsibilities to manage their septic systems. Other goals provide guidance on

direct management responses needed to address community sewer needs in areas that have identified septic system problems. The remaining recommendations emphasize the need to coordinate management efforts and to promote effective communication between all relevant parties, including individual homeowners.

Goal One: Extend the centralized sewer system where practical to areas with known septic system problems. ***Recommendations include:***

- Update centralized sewer service maps at least once every five years to determine areas that still rely on septic systems to meet their wastewater treatment needs.
- Utilize regulations and incentives, as appropriate, to encourage homeowners relying on septic systems to connect to the centralized sewer system.

Goal Two: Improve coordination between SC DHEC, county health departments, water and sewer utility providers, local governments, and homeowners to prevent incidences of septic system failure and to pursue appropriate alternatives for communities that become designated as Environmentally Distressed Communities on the SC DHEC Priority List of Sewer Needs. ***Recommendations include:***

- Develop a long-term funding mechanism to assist homeowners with the expense of connecting to the centralized sewer system. Potential funding sources could include the USDA Rural Development Home Repair Loan and Grant program or the Community Development Block Grant program.
- Develop a specific and comprehensive mitigation protocol for communities that become designated as Environmentally Distressed or as Imminent Health Hazard areas.
- Improve the recordkeeping of septic system permits to make them more accessible to homeowners seeking to know the installation and maintenance history of their septic systems and to watershed managers trying to account for septic system problems in their communities.
- Be sure that communities relying on septic systems that are not currently on SC DHEC's Environmentally Distressed community list are regularly surveyed. This allows homeowners, county governments, and sewer utility providers the opportunity to identify and address septic system problems in a timely manner instead of waiting until problems escalate and require more urgent action.
- Encourage relevant agencies, to develop permitting criteria that prohibits installation of new septic systems within a certain distance of waterbodies and shellfish harvesting areas identified on the South Carolina 303(d) list of impaired waters.
- Consider adopting provisions within local zoning and development regulations that prevents the use of septic systems in areas not suitable for privately owned and operated on-site wastewater treatment systems.

Goal Three: Strategically target homeowner awareness efforts for residents of communities that rely heavily on septic systems for on-site wastewater treatment. ***Recommendations include:***

- Widely distribute literature containing information about the proper maintenance of septic systems, common indicators that the system could be failing, and the environmental consequences associated with malfunctioning septic systems.
- Utilize multiple outlets to relay septic system management information including pamphlets, educational presentations, and on-site public workshops.
- Consider mailing reminders to homeowners to encourage them to have their septic system pumped out and/or inspected on a regular basis.
- Make homeowners aware when a sewer line extension becomes available and inform them of the costs and procedures necessary to connect to the centralized sewer system.

Goal Four: Encourage local communities to develop and enforce septic system and sewer use ordinances to reduce public health and environmental problems associated with septic systems. ***Recommendations include:***

- Require homeowners to tie into central sewer when service becomes available.
- Require all new septic system installations to be designed with an access manhole or port system to improve inspection capabilities.
- Require inspections of septic systems prior to the sale of real estate. Ensure that the inspector has appropriate SC DHEC professional licenses and certifications.
- Incorporate septic system capacity criteria based on the size of the residential structure.
- Provide detailed definitions to establish clear guidance on what constitutes a *failing septic system* and a septic system that is in *good operating condition*.
- Include enforcement provisions that require homeowners to repair or replace septic systems that are determined to be failing.

Goal Five: Develop programs to provide incentives to install water conservation devices on faucets, toilets, and showerheads, focusing outreach efforts to target homeowners that rely on septic systems.

Goal Six: Incorporate regular assessments of septic system failures as part of an overall water quality monitoring program in the Waccamaw region. This will improve watershed management efforts to address fecal coliform 303 (d) impairments in the Waccamaw region. ***Recommendations include:***

- Prioritize areas that have an established TMDL boundary for fecal coliform and have suspected septic system problems.
- Investigate instances of illicit discharges from failing septic systems into nearby ditches or storm drains.

Chapter Six: Nonpoint Source Pollution

INTRODUCTION

A comprehensive water quality management plan must include a full assessment of non-point sources of pollution that may be entering the surface water or groundwater systems within a watershed. There are many inherent challenges to identifying all sources of non-point source pollution and developing a strategy to minimize their impacts on our water resources. Non-point sources of pollution typically cannot be traced back to a single definitive pollutant source location. The pollutant load can accumulate over a large geographic area and enter the waterway through multiple pathways versus a single discharge pipe or outfall from a point source location (i.e. at a wastewater treatment plant or an industrial site).

Each watershed has its own set of non-point source pollution concerns, based on a wide range of factors including land use, population growth, and the context of the natural environment itself. The first objective of this chapter is to identify the sources of known non-point sources of pollution that exist in the Waccamaw region. Upon analyzing the difficulties of controlling non-point sources of pollution in the Waccamaw region, this chapter describes several management strategies that can be implemented to reduce non-point source pollutant loads. This plan also outlines specific water quality goals and policy recommendations to provide long-term guidance on how management entities within the Waccamaw region can help to minimize the harmful impacts of non-point sources of pollution.

NON-POINT SOURCE POLLUTION ISSUES AND CHALLENGES

The Waccamaw region has a wide range of land uses including agriculture, silviculture, industrial, low density rural residential, and high density urban commercial and residential areas. Each of these land use types has varying potentials of contributing non-point sources of pollutants to the natural environment, requiring specific management strategies to prevent or minimize pollution impacts. As the population of the region continues to grow, the natural and urban landscape will certainly change as well. One of the most important objectives of managing non-point source pollution is to account for these changes in land use and development patterns. Watershed managers can then target resources and efforts towards addressing specific non-point source pollution concerns in our watershed based on the identified needs.

Below is a description of several non-point source pollution issues common in the Waccamaw region.

Agricultural Runoff

Agriculture is a prominent land use in the Waccamaw region. Activities associated with agriculture can have tremendous ecological impacts on our waterbodies. Several notable reports, including US EPA's annual *National Water Quality Inventory* briefing to Congress, mention agricultural runoff as being the greatest cause of water quality impairments of all pollution sources, both from point source dischargers and non-point sources. Depending on the specific activity of a farm site, agricultural lands can be a source of pathogenic bacteria from livestock, sedimentation from the cultivation of crops, excessive nutrients from the use of fertilizers, and chemicals from the application of pesticides.

Table 6-1 provides a general profile of the agricultural land use and activities in the Waccamaw region. The trends in agricultural land use differ between each county. Horry County has experienced the largest decrease in available farmland between 2002 and 2007. However, all three counties experienced a noticeable increase in the amount of total harvested cropland.

Table 6-1 Agricultural Land Use Information				
	Total Land in Farms	Average Size of Farm	Total Harvested Cropland	Total Woodland
Horry County	**2002-** 188,311 **2007-** 163,622	**2002-** 191 **2007-** 179	**2002-** 69,974 **2007-** 74,739	**2002-** 69,952 **2007-** 50,035
Georgetown County	**2002-** 54,691 **2007-** 57,647	**2002-** 242 **2007-** 229	**2002-** 8,695 **2007-** 11,156	**2002-** 30,914 **2007-** 31,157
Williamsburg County	**2002-** 205,904 **2007-** 209,402	**2002-** 170 **2007**- 174	**2002-** 61,855 **2007-** 75, 890	**2002-** 88,937 **2007-** 91,674
Notes: *Land units are measured in acres.* ***Source:*** *2007 Census of Agriculture- County Data. USDA, National Agricultural Statistics Service*				

Table 6-2 provides information on livestock production in the Waccamaw region. The primary non-point source pollution concern with livestock agricultural facilities is the runoff of untreated animal waste, which is loaded with high concentrations of nutrients and pathogenic bacteria, into nearby streams and rivers. Livestock agricultural areas are also prone to erosion due to the ongoing disturbance of ground cover by livestock. Watershed managers can encourage landowners to implement various best management practices to mitigate these problems. Proper fencing can be utilized to control direct livestock access to surface waterbodies. In addition, maintaining adequate riparian buffers adjacent to livestock areas can significantly reduce the amount of polluted runoff that can enter our streams.

Figure 6-1. This farm site utilizes wire fencing and a riparian buffer to protect nearby streams from livestock access and polluted agricultural runoff. *Photo courtesy of USDA Natural Resources Conservation Service*

At present, Concentrated Animal Feeding Operations (CAFOs) are regulated under a general NPDES "no discharge" permit in the state of South Carolina. Permit holders are required to build waste storage lagoons with a capacity sufficient to retain the volume of manure generated at the facility during the time between land applications, the normal rainfall that occurs between land applications, and the rainfall generated from the calculated twenty five year, twenty four hour storm event. Permitted facilities must also develop an animal facility management plan which outlines the land area and chosen crop used for manure application purposes. Facility managers must follow the agronomic land application rates for each viable crop grown on-site. As an outreach and education strategy, CAFO facility operators must also receive certification through Clemson University's Confined Animal Manure Managers Program.

A copy of the South Carolina NPDES General Permit for "No- Discharge" Concentrated Animal Feeding Operations can be accessed online at: http://www.scdhec.gov/environment/water/docs/g800000.pdf The Bureau of Water Agricultural Program at SC DHEC is in charge of administering this permit program. Information about the Agricultural Program at SC DHEC can be found online at: http://www.scdhec.gov/environment/water/agcafo.htm

Table 6-2 Agricultural Livestock Data					
	Farms with Cattle	Total Inventory of Cattle	Farms with Pigs	Total Inventory of Pigs	Farms with Poultry
Horry County	**2002-** 272 **2007-** 228	**2002-** 8,425 **2007-**10,446	**2002-** 30 **2007-** 30	**2002-** 43,900 **2007-** 42,079	**2002-** 58 **2007-** 70
Georgetown County	**2002-** 75 **2007-** 55	**2002-** 1,373 **2007-** 1,144	**2002-** 22 **2007-** 7	**2002-** 8,187 **2007-** (D)	**2002-** 22 **2007-** 7
Williamsburg County	**2002-** 131 **2007-** 135	**2002-** 4,868 **2007-** 4,682	**2002-** 45 **2007-** 25	**2002-** 11,503 **2007-** (D)	**2002-** 36 **2007-** 36
Notes: *Abbreviations- (D)- Withheld to avoid disclosing data for individual farmers*					
Source: *2007 Census of Agriculture- County Data. USDA, National Agricultural Statistics Service*					

Table 6-3 provides information on the application of manure, fertilizers, and chemicals used to control pests on agricultural lands in the Waccamaw region. These land management practices are essential to the production capabilities of many farm sites in the State of South Carolina. However, excessive or poorly timed application of these chemicals can result in contaminated runoff problems in local streams and rivers. Excessive irrigation can cause erosion, and transport nutrients, pesticides, and heavy metals. Excessive irrigation has also been known to cause the buildup of selenium, which can adversely affect waterfowl reproduction. Efficient irrigation water use can minimize potential water quality concerns related to this aspect of cropland management.

Figure 6-2. Farmer applying nitrogen-based fertilizer to cropland. It is generally much more effective to apply fertilizers in smaller amounts more frequently than applying them all at once. This also reduces the amount of nitrogen from entering groundwater or surface water system. ***Photo courtesy of USDA Natural Resources Conservation Service.***

Farmers also apply nutrients in the form of manure, sludge, and fertilizers to enhance crop production. If not applied at appropriate agronomic rates and only during suitable weather conditions, nutrients can easily run off of agricultural land areas and enter nearby waterbodies. Elevated nutrient loads can cause harmful algal blooms resulting in the loss of aquatic habitats and the degradation of recreational areas. Developing a nutrient management plan that establishes the amount and frequency of nutrient application is an effective way to ensure desired crop yields in a cost efficient manner while minimizing nutrient pollution risks.

Another common chemical application on agricultural lands is the use of pesticides. Pesticides can pose serious environmental threats by harming fish and wildlife and contaminating food sources. It is highly recommended that all pesticide users implement Integrated Pest Management strategies to reduce the offsite migration of pesticides and minimize exposure of these chemicals to humans and wildlife. Specific management techniques should be utilized based on the soil characteristics, pest history, and climate conditions of a particular site. In order to provide further water quality protection from pesticide use, SC DHEC has recently begun to administer the NPDES General Permit for Discharges from the Application of Pesticides. The permit incorporates various Integrated Pest Management principles specific to each of the classes of pests that are commonly treated in the State of South Carolina. A copy of the permit can be accessed online at: http://www.scdhec.gov/environment/water/docs/npdes_permit.pdf More information about the pesticide application and the status of this permit issuance can be found at SC DHEC's Bureau of Water website at http://www.scdhec.gov/environment/water/npdes_pesticide.htm

Table 6-3 Chemical Application Data for Agricultural Lands							
	Acres of Irrigated Land	Acres Treated with Commercial Fertilizer, Lime and Soil Conditioners	Acres Treated with Manure	Acres Treated with Chemicals Used to Control Insects	Acres Treated with Chemicals Used to Control Weeds, Grass or Brush	Acres Treated with Chemicals Used to Control Nematodes	Acres Treated with Chemicals Used to Control Diseases in Crops and Orchards
Horry County	**2002-** 741 **2007-** 1,316	**2002-** 78,475 **2007-** 75,791	**2002-** 2,263 **2007-** 1,233	**2002-** 34,886 **2007-** 34,043	**2002-** 46,927 **2007-** 46,146	**2002-** 11,317 **2007-** 11,571	**2002-** 6,900 **2007-** 3,490
Georgetown County	**2002-** 1,325 **2007-** 710	**2002-** 8,658 **2007-** 7,925	**2002-** 215 **2007-** (D)	**2002-** 4,189 **2007-** 6,741	**2002-** 5,244 **2007-** 6,327	**2002-** 405 **2007-** 1,248	**2002-** 310 **2007-** (D)
Williamsburg County	**2002-** 758 **2007-** 913	**2002-** 60,032 **2007-** 73,927	**2002-** 2,440 **2007-** 3,194	**2002-** 36,214 **2007-** 41,979	**2002-** 38,818 **2007-** 45,719	**2002-** 15,680 **2007-** 15,944	**2002-** 2,521 **2007-** 17,913
Notes: *Land units are measured in acres. Abbreviations- (D)- Withheld to avoid disclosing data for individual farmers* ***Source:*** *2007 Census of Agriculture- County Data. USDA, National Agricultural Statistics Service*							

As the tables above indicate, our use of agricultural lands changes regularly and is influenced by weather patterns, economic trends, innovative agricultural management practices and technologies, along with many other factors. It is helpful to understand these factors and work with agricultural landowners to maintain viable local agricultural opportunities, while protecting the health of our land and water resources.

The United States Department of Agriculture oversees several conservation and stewardship programs through the Natural Resources Conservation Service aimed at engaging farmers in initiatives to minimize water quality impacts associated with agricultural activities. Programs vary significantly and include long-term regionwide conservation plan development, individual property assessment, and direct technical assistance to implement recommended management practices. Additional information about the programs and services offered by the Natural Resources Conservation Service can be found on their website at: http://www.nrcs.usda.gov/

Forestry Activities

Due to favorable soil and climate conditions, South Carolina historically has been a productive silviculture region in the eastern United States. In fact, it is estimated that a total of 66% of South Carolina's entire land area is comprised of timberland (SC *DHEC Pee Dee Basin Watershed Water Quality Assessment*). The South Carolina Forestry Commission oversees forestry related activities throughout the state. The commission divides the management of state forest lands into six operational units. The three-county Waccamaw region is part of the six-county Black River Unit.

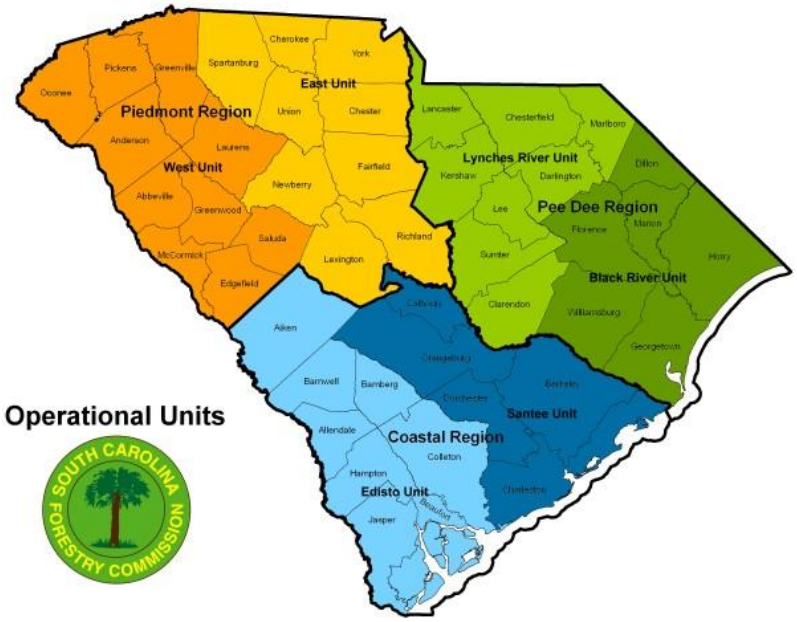


Figure 6-3- SC Forestry Commission Statewide Operational Units

Intensive land based activities, such as silviculture, need to be properly managed in order to minimize impacts to our watershed resources. The biggest pollution concern related to silviculture activities is the disturbance of soils, which can lead to increased sedimentation in adjacent waterways. Timber extraction requires the construction of access roads, which disrupts the ground surface and exposes loose soil. In addition, tree harvesting exposes soil to erosion, increasing the potential for sedimentation. Foresters often use fertilizers and pesticides in the regular management of their forest lands. These chemicals along with oil and grease residues from heavy construction and harvesting equipment have a high propensity for binding to sediment particles and then often get transported to nearby surface waters via soil erosion.

Serious environmental impacts can occur when forestry activities encroach too closely to streams and lakes. Removal of vegetation in what is termed the "Streamside Management Zone" is likely to cause direct soil erosion into the waterway due to its close proximity to the stream's shoreline. Land disturbance in this area can destabilize the streambank, further exacerbating the magnitude of the erosion problem. Trees are a vital component of a healthy natural stream ecosystem. Trees provide shade which helps to reduce the temperature of the waterbody. Cooler water temperatures help to maintain an adequate level of dissolved oxygen in the waterbody, which is vital to aquatic species survival. Sedimentation can lead to detrimental physical modifications of aquatic habitat areas. Fish often utilize streambank areas and tree roots for shelter and as spawning areas.

The key to minimizing forestry impacts is to develop a comprehensive pre-harvest site management plan, which strategically locates the development of forest access roads, identifies the proper streamside management zones, outlines parameters for all forestry activities in various weather conditions, and establishes a post-harvest restoration strategy. For all on-site activities, best management practices should be followed as prescribed by the South Carolina State Forestry Commission. Some of the primary considerations when creating a management plan is to conduct an assessment of the local seasonal weather conditions, an inventory of soil types, the location of all surface waterbodies, and a topographical survey, which accounts for slope variations in the surrounding terrain. Although several activities related to agriculture and forestry are exempt from provisions under the federal Clean Water Act, the US EPA has encouraged states to develop volunteer forestry certification programs, which train professional foresters about sustainable forestry practices. The South Carolina Forestry Commission has developed a Best Management Practice Courtesy Exam program for foresters in South Carolina. Since its inception, BMP compliance has steadily increased and currently it is estimated that BMP compliance is achieved at 98.6% of all timber harvesting operation sites throughout the state. In addition, foresters have important responsibilities in assisting watershed managers implement practices to comply with pollutant loads established in Total Maximum Daily Loads. Even if timber harvesting areas are not the suspected source of impairment, forestry management can be an effective approach to establishing riparian buffers to minimize non-point source pollution runoff on a larger watershed scale.

In addition to the management of rural timberland areas, the South Carolina Forestry Commission also oversees an Urban and Community Forestry Program. The commission recognizes the multiple benefits of urban tree landscapes including reduced stormwater runoff, enhanced groundwater recharge capabilities, and decreased soil erosion and stream sedimentation. To promote and encourage the establishment of a well managed urban tree program, the South Carolina Forestry Commission issues community forestry grants throughout the state. The South Carolina Forestry Commission also partners with the National Arbor Day Foundation, the US Conference of Mayors, the National League of Cities, and the US Forest Service in sponsoring the Tree City USA program, which encourages local governments to establish a community tree commission or designate a municipal department to oversee tree protection. The program also requires participating communities to adopt tree care ordinances, and to dedicate a regular funding source to manage the local

community forestry program. Currently, Myrtle Beach, North Myrtle Beach, Surfside Beach, Georgetown, and Conway are all participating in the Tree City USA program.

One of the key goals stated in the Forestry Commission's strategic plan is to "enhance water quality protection by increasing awareness and compliance with South Carolina Best Management Practices for Forestry". This goal is to be achieved through the facilitation of several training programs and by building partnerships with public and private entities. The agency's strategic plan also focuses on the need for continued collaboration with local governments and to raise awareness amongst the general public, policy decision makers, and other key community leaders about the value of our state's forestry resources and the need to protect these resources into the future. There are many opportunities to increase collaboration with the SC Forestry Commission and local forestry industry stakeholders to continue to benefit from our forestry resources while protecting the landscape so that water quality problems associated with silviculture activities can be prevented.

More information about the South Carolina Forestry Commission can be found at: http://www.state.sc.us/forest/

Stormwater runoff

An ongoing challenge in reducing non-point sources of pollution is being able to effectively manage stormwater runoff from urbanized areas within our watersheds. An inherent characteristic of urban development is the substantial land coverage of impervious surfaces associated with roadways, parking lots, and buildings. As the Waccamaw region grows and continues to become an attractive location for both permanent residents and seasonal visitors, urban development will likely continue well into the future. Historically most of the urbanized areas in our region has been concentrated along the beachfront Grand Strand communities and in the county seats of Conway, Kingstree, and Georgetown. Growth pressures have expanded residential and commercial development well past the Atlantic Intracoastal Waterway into new areas such as Carolina Forest and elsewhere. This physical alteration of the natural landscape has changed the hydrological dynamic of our watershed system, both on a local scale and on a regional scale. Stormwater runoff rates typically peak sooner and at larger quantities in developed land areas in comparison to undeveloped land areas, creating additional environmental stressors on local waterways. **Chapter Two, Description of the Waccamaw Region Study Area**, provides an assessment of land cover change in each county between 1996 and 2006. A land use summary is also provided in the general profile for each sub-watershed in **Chapter Three, Watershed Assessments.**

Figure 6-4. A typical storm sewer collects runoff from surrounding impervious surfaces such as roadways which is then transported untreated into a nearby waterway. *Photo Courtesy of Clemson University's Carolina Clear Program*

There are many stormwater runoff pollutants of concern that have the potential to have significant impacts on the water quality of our streams and rivers. The source of these pollutants is generally dependent on the land use activities occurring within the watershed. Contaminants commonly transported by stormwater runoff include sediments, metals, nutrients, bacteria, hydrocarbons, and other toxic pollutants. In addition, aquatic habitats can be degraded due to the presence of oxygen-demanding substances and from elevated surface water temperatures. Reducing these pollution threats requires both site scale and watershed scale structural and non structural management practices. Given the complexity and scope of this water quality issue, stormwater management requires a comprehensive framework supported by the efforts of multiple stakeholders.

Although specific stormwater management strategies will often vary depending on the pollutant of concern and the watershed characteristics, there are some common overall objectives of stormwater management. One of the primary objectives is to minimize the amount of impervious land coverage and to disconnect existing impervious areas within the watershed. A second objective is to implement development practices and watershed management strategies to promote stormwater retention or infiltration in the targeted watershed. Another key objective is to ensure that known sources of pollutants are not exposed to stormwater runoff, where practical. Finally, an additional objective is to institute measures that help remove pollutants before stormwater runoff enters natural waterbodies.

Two main approaches to managing stormwater runoff are through the implementation of structural and non-structural practices. Non-structural practices are designed to reduce pollutant loads or manage polluted runoff at its source. This can be accomplished via regulatory controls such as municipal codes and ordinances. Much of the focus of non-structural management strategies focuses on land use practices. Sensitive areas within a watershed can be safeguarded from harmful development by designating it within a protective zoning district or by pursuing other means such as a conservation easement. Public awareness initiatives are a vital aspect of non-structural stormwater management efforts as well. Individuals have a significant role in minimizing stormwater pollution sources, even by just altering some very simple activities such as car maintenance, fertilizer and pesticide application, and pet waste disposal.

Structural management practices involve engineered designed control mechanisms which can alter the flow rates and other characteristics of stormwater runoff from an individual site or on a larger neighborhood scale. Several types of engineered systems such as catch basin filtration devices are now readily available. These units can be easily retrofitted into new or existing structures. In addition to providing effective filtration of solid pollutants such as debris and sediment, they can be configured to also help remove metals, nutrients, bacteria, hydrocarbons, and other harmful pollutants.

It is important to be mindful that non-structural and structural stormwater management practices are both necessary in achieving stormwater management objectives and ought to complement each other to achieve desired water quality improvements. One of the emerging trends in stormwater management is the advance of green infrastructure and Low Impact Development (LID) strategies. These stormwater management opportunities are discussed in further detail later in this chapter.

Industrial Stormwater

Figure 6-5. Example of an industrial site that is properly covering raw material stockpiles. ***Photo courtesy of Tetra Tech, Inc.***

At many industrial sites, routine activities such as material storing and handling, equipment maintenance and cleaning, and other industrial processes are often exposed to wet weather. Controlling stormwater runoff pollution sources at industrial facilities is critically important in ensuring that the water quality in nearby streams and rivers is protected. Since 1990, the US EPA has overseen permitting efforts to regulate stormwater discharges. SC DHEC regulates 29 different industrial sectors under the NPDES General Permit for Storm Water Discharges Associated with Industrial Activities (Except for Construction). One of the primary requirements to obtain coverage under the permit is to develop a Stormwater Pollution Prevention Plan which includes an assessment of all potential sources of stormwater runoff pollution and a description of the control measures, such as site specific best management practices, maintenance procedures, inspection, and employee training, that will be implemented at the facility.

The US EPA provides a comprehensive fact sheet for each regulated industrial sector, which explains the pollutants of concern, suggested best management strategies, and additional reference material pertaining to that particular industrial sector. These industrial stormwater fact sheets can be accessed online at:
http://cfpub.epa.gov/npdes/stormwater/swsectors.cfm

Table 6-4 provides a complete list of each of these regulated industrial sectors. **Appendix H** provides a list of all the facilities in the Waccamaw region that are regulated under this permit program. A copy of the NPDES General Permit for Storm Water Discharges Associated with Industrial Activities (Except Construction) can be accessed online at: http://www.scdhec.gov/environment/water/docs/SCR000000.pdf This permit is administered by the Industrial Stormwater Permitting and Compliance Division at SC DHEC Bureau of Water. Additional information can be found at SC DHEC's website at: http://www.scdhec.gov/environment/water/swnindustact.htm

Table 6-4 Industrial Sectors Regulated under NPDES Stormwater Permit for Industrial Activities	
Timber Products	*Scrap Recycling and Waste Recycling*
Paper and Allied Products Manufacturing	*Steam Electric Generating Facilities*
Chemical and Allied Products Manufacturing and Refining	*Land Transportation and Warehousing*
Asphalt Paving and Roofing Materials and Lubricant Manufacturing	*Water Transportation*
Glass, Clay, Cement, Concrete, and Gypsum Product	*Ship and Boat Building and Repair Yards*
Primary Metals	*Air Transportation Facilities*
Metal Mining (Ore Mining and Dressing)	*Treatment Works*
Coal Mines and Coal Mining-Related	*Food and Kindred Products*
Mineral Mining and Dressing	*Textile Mills, Apparel, and Other Fabric Products*
Hazardous Waste Treatment, Storage, or Disposal	*Furniture and Fixtures*
Landfills, Land Application Sites, and Open Dumps	*Printing and Publishing*
Automobile Salvage Yards	*Rubber, Miscellaneous Plastic Products, and Miscellaneous Manufacturing Industries*
Leather Tanning and Finishing	*Fabricated Metal Products*
Transportation Equipment, Industrial or Commercial Machinery	*Electronic and Electrical Equipment and Components, Photographic and Optical Goods.*
***Source:** SC NPDES General Permit for Storm Water Discharges Associated with Industrial Activities (Except Construction)*	

Discharges Associated with Non-metal Mineral Mining Facilities.

Mining activities entail various processes which involve the discharge of water from a facility site. SC DHEC recently renewed the NPDES General Permit for Discharges Associated with Non-metal Mineral Mining Facilities in September, 2010. The types of facilities covered by this permit include operations consisting of the mining of sand, gravel, clay, fill dirt, kaolin, vermiculite, and dimension stone. The permit focuses on the discharge of groundwater dewatering, stormwater, mine process wastewater, mine equipment wash water, and dredge water from a permitted facility.

A list of entities covered by this permit program within the Waccamaw region is provided in **Appendix I**. The permit can be accessed online at http://www.scdhec.gov/environment/water/docs/scg730000.pdf

Marinas and Boating

As a coastal area with an extensive network of inland rivers, there are numerous opportunities for recreational boating and a sufficient number of marina facilities to meet this demand throughout the Waccamaw region. Marina facilities exist in Georgetown, Murrells Inlet, Pawleys Island, Litchfield Beach, Myrtle Beach, North Myrtle Beach, Little River, and Conway. Many residents also own their own private docks along many of the waterways throughout the Waccamaw region. Public landing access points are also common throughout the region. Due to the direct proximity to our waterways, marine operations can cause significant water quality impacts if these sites and associated activities are not properly managed.

SC DHEC-Office of Ocean and Coastal Resource Management (SC DHEC-OCRM) in partnership with the South Carolina Marine Association has developed the Clean Marina Program as a recognition and outreach program to encourage marina owners to utilize best management practices in the operation of their facilities. Local marinas that are currently participating in the South Carolina Clean Marina Program include Osprey Marina in Myrtle Beach and Reserve Harbor Marina in Litchfield Beach. A program guidebook was recently developed that explains the purpose and the participation requirements of the program. The guidebook also provides a comprehensive list of activities and best management practices to minimize boat-related pollution activities in the state's waterways. Suggested management practices address concerns related to boat storage, fueling, mechanical repairs, painting, cleaning, and general facility maintenance. The guidebook is an excellent resource for individual boaters as well to learn about new ideas and various alternatives to maintain their boats in as environmentally conscious way as possible.

The 2010 South Carolina Clean Marina Guidebook can be accessed at the following website: http://www.scdhec.gov/administration/library/CR-006968.pdf

One of the major facility needs of most recreational boaters is access to a septage pumpout station. It is critically important to enforce regulations pertaining to illicit discharge of onboard septage into restricted waterways. Through the federal Clean Vessel Act, the United States Fish and Wildlife Service administers a grant program established to expand the number of available septage pumpout stations throughout the nation's waterways. This program intends to support the recreational boating industry while protecting the environmental health of local waterways. An assessment of septage pumpout station needs in the Waccamaw region should be conducted in order to evaluate the benefits of pursuing this grant opportunity. More information about the Clean Vessel Act program can be found on the United States Fish and Wildlife Service website at: http://wsfrprograms.fws.gov/Subpages/GrantPrograms/CVA/CVA.htm

NON-POINT SOURCE POLLUTION MANAGEMENT PROGRAMS

National Pollutant Discharge Elimination System (NPDES) Permit Program for Stormwater Management

The National Pollutant Discharge Elimination System (NPDES) permit program was expanded in 1990 to include Stormwater Discharges from Municipal Separate Storm Sewer Systems (MS4s). This relatively new permit program is intended to reduce the pollutant load that is commonly transported through our nation's stormwater systems and discharged without treatment into our local waterways. The permit program was instituted in two phases; the first phase addresses larger urban areas throughout the United States and the second phase addresses smaller yet significantly urbanized areas around the country. Several municipalities and densely populated unincorporated communities along the coastal portions of Horry and Georgetown Counties meet the population thresholds that require them to obtain coverage under the Phase II NPDES General Permit for Storm Water Discharges from Regulated Small Municipal Separate Storm Sewer Systems (SMS4).

Table 6-5 below is a list of NPDES Phase II Small Regulated MS4 Jurisdictions of the Myrtle Beach Urbanized Area including Forestbrook, Garden City, Little River, Murrells Inlet, Red Hill and Socastee Census-Designated Places (CDPs). **Figure 6.6** is a map illustrating the boundaries of the MS4 jurisdictions within the Myrtle Beach Urbanized Area.

Table 6-5 NPDES Phase II Small Regulated MS4 Jurisdictions in the Waccamaw Region	
Atlantic Beach	*North Myrtle Beach*
Briarcliffe Acres	*Surfside Beach*
Conway	*Georgetown County*
Myrtle Beach	*Horry County*

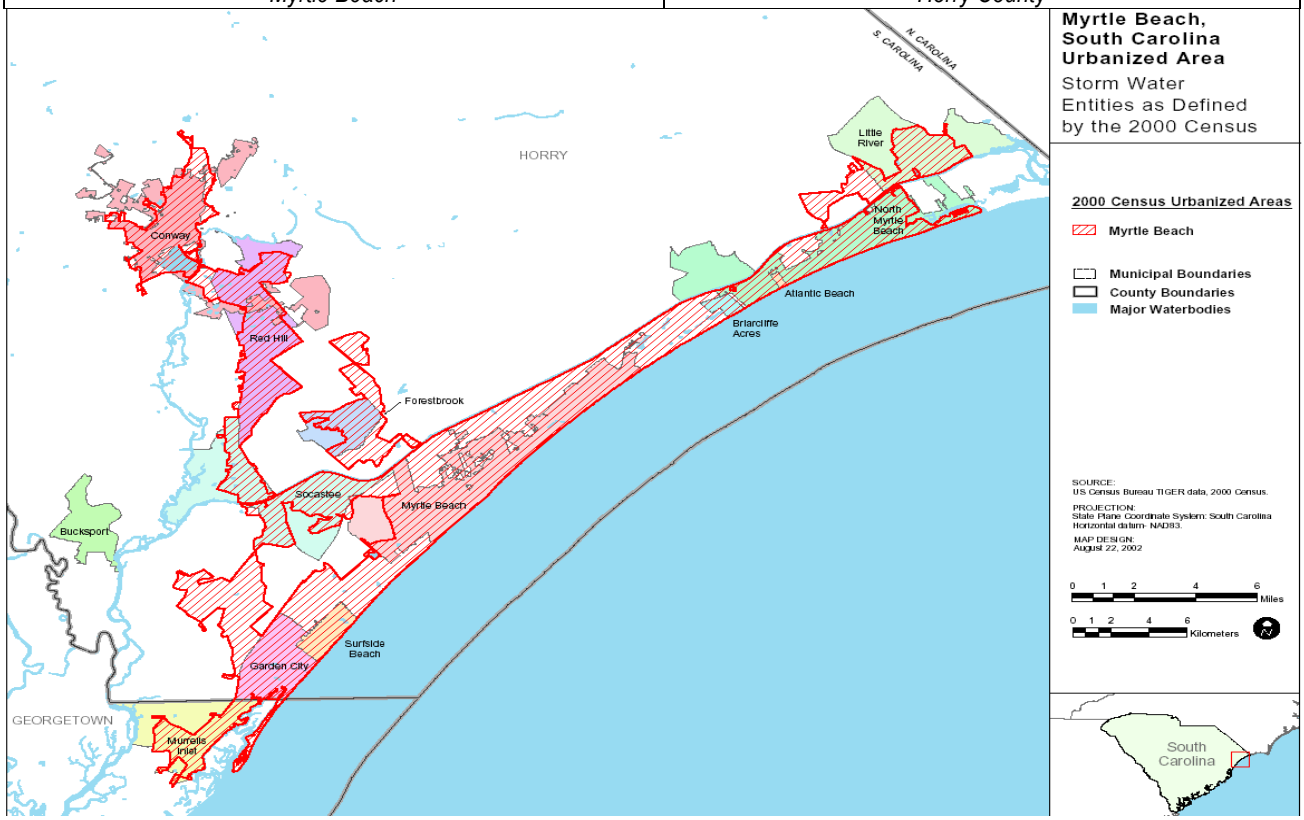


Figure 6-6 NPDES Phase II SMS4 permit boundaries as of the 2000 Census enumeration

SC DHEC is the agency authorized to issue NPDES permits for stormwater discharges. They have structured the MS4 permit as a general permit with the same conditions in place for all of the regulated small MS4s throughout the state. There are six main elements known as "minimum control measures" that make up the central requirements of the permit. As part of the permit application process, each MS4 must submit a list of appropriate BMPs and measurable goals for each minimum control measure. The six minimum control measures are explained below.

Figure 6-7 Waccamaw region MS4 communities have instituted a storm drain marking program as a means to increase public awareness about polluted runoff issues and to engage citizens in stormwater management activities. *Image courtesy of the Coastal Waccamaw Stormwater Education Consortium*

- **Public Education and Outreach on Stormwater Impacts:** Requires permittees to implement a comprehensive stormwater education and outreach program in their communities. The program must define outreach objectives for at least three community-wide stormwater issues based on the identified pollutants of concern. Outreach messaging must target at least three residential issues and three industrial/ commercial issues. Based on the chosen outreach issues, the permittee must develop appropriate educational materials, such as signage, printed materials, radio and television advertisements, and website information.
- **Public Participation/ Involvement:** This minimum control measure is intended to encourage the public to participate in the development and implementation of the MS4 community's Stormwater Management Plan. Permitted MS4 communities are

encouraged to consider the creation of a representative citizen group to assist in the Stormwater Management Plan development process. Permittees must also facilitate opportunities such as stream cleanups, storm drain marking, and water quality monitoring to directly engage the general public in the Stormwater Management Plan activities.

- **Illicit Discharge Detection and Elimination:** This control measure establishes the basis for MS4 communities to institute local ordinances and regulations to help eliminate non-stormwater discharges into the stormwater system. Stormwater management ordinances provide the MS4 community with the legal authority to detect, investigate, and enforce prohibited illicit discharges within the MS4 community. The US EPA is one of many informational sources with model ordinances and guidance on how to develop a stormwater management ordinance. For information on model ordinance language visit US EPA's website at http://www.epa.gov/owow/NPS/ordinance/stormwater.htm

  This control measure also requires permittees to update their community's storm sewer map providing details on the location of each stormwater outfall, and the priority areas within the system that have a high likelihood of illicit discharges. Finally this control measure outlines the field screening and monitoring procedures for detecting illicit discharges to the storm drain system.

- **Construction Site Stormwater Runoff Control:** This permit requirement specifically deals with water quality impacts related to construction activities. Under this control measure, permittees must administer a program to ensure that property owners who engage in construction activities select and install stormwater control measures which comply with the South Carolina NPDES General Permit for Stormwater Discharges from Construction Activities and the South Carolina Stormwater Management and Sediment Reduction Regulations 72-300, along with any other applicable local regulations. Among the requirements includes the submission of a stormwater management/erosion and sediment reduction plan, commonly referred to as a Stormwater Pollution Prevention Plan prior to the disturbance of any land.

Figure 6-8 This storm drain inlet protection device helps to prevent sediment that may runoff an active construction site from entering the storm drain system. ***Photo courtesy of US EPA.***

- **Post-Construction Stormwater Management in New Development:** Under this minimum control measure MS4 communities are required to implement a program to control stormwater discharges from private and public new development and redeveloped sites that disturb at least one acre of total land area. Permittees must institute development design standards that promote the infiltration, evapotranspiration, or reuse of on-site rainfall and can demonstrate effective runoff reduction and pollutant removal necessary to maintain predevelopment hydrological conditions and to protect water quality to the maximum extent practicable.

- **Pollution Prevention/ Good Housekeeping for Municipal Operations:** This final minimum control measure is intended for MS4 communities to take a holistic approach to achieving the ultimate goal of preventing or reducing pollutant runoff due to their own municipal operations as part of the community's Stormwater Management Plan. The MS4 community must identify and map all municipally-owned and operated facilities and all associated stormwater controls. The permittee must specifically identify high priority facilities and implement good housekeeping procedures to ensure proper stormwater pollution controls are in place.

US EPA provides guidance on potential best management practices that can be implemented to fulfill the requirements of each of the six minimum control measures outlined in the NPDES General Permit for Storm Water Discharges from Regulated Small Municipal Separate Storm Sewer Systems (SMS4). The National Menu of Stormwater Best Management Practices can be accessed online at http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm

It is important to note that the NPDES permit for designated Phase II Small MS4s is due for renewal in 2011. Local governments need to be alert to possible changes to the jurisdictional coverage boundaries outlined in the permit. This program is administered by the Municipal Separate Storm Sewer System permitting division within the Bureau of Water at SC DHEC. Additional information about this permitting division can be found at SC DHEC's website at: http://www.scdhec.gov/environment/water/swnsms4.htm

The existing NPDES General Permit for Storm Water Discharges from Regulated Small Municipal Separate Storm Sewer Systems (SMS4) can be accessed online at: http://www.scdhec.gov/environment/water/docs/scs000000.pdf

The NPDES Stormwater Discharge General Permit Program was in the early development phase at the time the last Waccamaw Region Section 208 Plan update was adopted. Our region's water quality management efforts have benefited tremendously from the implementation of the NPDES MS4 permit program. Looking forward, the Waccamaw Region Section 208 Plan will integrate the goals and strategies that have been developed through our local stormwater management programs. One of the intentions of this Section 208 Plan update is to support these stormwater management efforts on a regional level and help coordinate activities amongst both point-source and non-point source designated water quality management entities within the Waccamaw region.

SC NPDES General Permit for Stormwater Dischargers from Large and Small Construction Activities

SC DHEC administers a general permit to regulate stormwater discharges that enter surface waters from construction site activities. Allowable stormwater discharges primarily consist of stormwater associated with the construction activity and discharges from support activities such as equipment and material storage areas, concrete and asphalt batch plants, and excavated material disposal areas. Other allowable non-stormwater discharges associated with construction activities include discharges from fire hydrants, vehicle and equipment non-detergent washwater, landscape irrigation, water used to control dust, and building exterior washwater.

As part of the permit application procedures, a Stormwater Pollution Prevention Plan (SWPPP) must be submitted which identifies all potential sources of pollution that may affect the quality of stormwater discharged from the construction site and a description of pollution reduction practices that will be implemented at the construction site. The SWPPP must also include information about the type of development site (i.e. residential housing, shopping mall, etc), a description of the sequence and scope of all planned major disturbance activities, and an estimate of the total land area that will likely be disturbed or impacted. In addition, a construction site map must be submitted which indicates the stormwater flow characteristics, areas of soil disturbance, location of surface waters and wetlands, and all on-site stormwater controls.

Construction activity stormwater discharges containing pollutants of concern within an established Total Maximum Daily Load boundary are not allowed unless specific control measures are incorporated into the permit holder's SWPPP. All applicable wasteload allocation requirements for the TMDL are in effect for all permit holders. Where applicable, requirements under the US Army Corps of Engineers' 404 permit program, which regulates the discharge of dredged or fill material to surface waters or wetlands, must be fulfilled prior to being granted coverage under the Construction General Permit.

A copy of the SC NPDES General Permit for Stormwater Discharges from Large and Small Construction Activities can be accessed online at: http://www.scdhec.gov/environment/water/docs/finalcgp.pdf

Clemson University Certified Erosion Prevention and Sediment Control Inspector Program (CEPSCI)

The Clemson University CEPSCI educational outreach program was developed to help address water quality problems associated with land disturbing activities in South Carolina. The program is designed to train individuals about the proper design, installation, maintenance, and inspection of appropriate erosion prevention and sediment control practices. The program organizes one-day workshops which introduce attendees to the latest practices in erosion control techniques and provides an overview of all pertinent state laws and regulations. Training also consists of assistance with conducting a site review to develop environmentally sensitive grading and drainage plans, and the selection of suitable best management practices. The program also has a certification component which includes the successful completion of a certification exam. At the end of the program, qualified participants become a SC Certified Erosion Prevention and Sediment Control Inspector.

For more information about Clemson University's CEPSCI program visit the following website:
http://www.clemson.edu/public/cepsci/index.html

Clemson University Certified Stormwater Plan Reviewer Program (CSPR)

An additional public service program offered by Clemson University is the Certified Stormwater Plan Reviewer program. Participants are trained on the proper review of stormwater and sediment control plans for development sites to determine if a proposal submittal meets all pertinent regulatory requirements. The program is organized as a two-day workshop culminating in an exam. Upon satisfactory completion of the program, participants become a SC Certified Stormwater Plan Reviewer, which is valid for five years. The workshop covers topics including innovative techniques and best management practices in stormwater and sediment control; stormwater management requirements; plan submittal, review, and approval process; plan review checklists; and common submittal deficiencies.

For more information about Clemson University's CSPR program visit the following website:
http://www.clemson.edu/t3s/cspr/index.htm

SC Department of Transportation (SC DOT) Stormwater Management Program (PERMIT # SCS 040001)

The South Carolina Department of Transportation has been classified as a large MS4 management entity under the NPDES permit program. This provides the agency permit coverage to discharge stormwater via SC DOT owned and maintained stormwater sewer facilities in accordance with conditions outlined in the issued permit. SC DOT is also required to comply with the SC NPDES General Permit for Stormwater Dischargers from Large and Small Construction Activities, which regulates stormwater runoff from construction project sites. In addition, the agency has obtained coverage under the SC NPDES General Permit for Storm Water Discharges Associated with Industrial Activities (Except Construction) for each of the agency's county maintenance facilities throughout the state. Because SC DOT maintains a large percentage of the arterial highways and local community streets throughout the Waccamaw region, their stormwater management efforts are critical to the long-term protection of our local water resources. It is important for our local governments and water resource managers to work closely with SC DOT so that future local transportation improvement projects can be designed to incorporate storrmwater management practices that will protect local waterways.

A copy of SC DOT's Large MS4 NPDES permit can be accessed online at:
http://www.epa.gov/npdescan/SCS040001FP.pdf

Further information about the SC DOT Stormwater Program can be found on their website at:
http://www.scdot.org/ms4/default.shtml

NON-POINT SOURCE POLLUTION MANAGEMENT OPPORTUNITIES

As awareness and knowledge about the impacts of non-point source pollution continue to advance, new management strategies are regularly being explored and developed. This section examines green infrastructure, which has been a common stormwater management approach supported by the US EPA and several partnering agencies and organizations. This section provides a general overview of green infrastructure applications and their anticipated social, environmental, and economic benefits. This section also discusses challenges to implementing green infrastructure practices and provides guidance on ways to pursue green infrastructure opportunities in our local communities.

Green Infrastructure can be described as an interconnected network of managed landscapes and conserved natural areas that function on a site scale and on a community-wide scale. Green infrastructure projects are strategically designed to mimic natural hydrologic conditions and to reduce the amount of polluted runoff in urban areas and surrounding watersheds. Depending on the design of each green infrastructure project, additional benefits include decreased stormwater infrastructure costs, reduced energy consumption, urban heat island mitigation, improved air quality, increased property values, enhanced wildlife habitats, and enhanced community outdoor recreation opportunities. Below is a general description of several types of green infrastructure on a site scale, neighborhood scale, and on a larger watershed scale.

Site Scale Applications

- ***Green Roofs*** reduce the impervious properties of typical rooftops, by partially or completely covering the building rooftop surface with suitable vegetative material and a sufficient growing medium. The purpose of a green roof is to intercept rainfall on the building's site and to minimize the volume of stormwater runoff that leaves a site. Ultimately the rainwater is released back into the atmosphere via evapotranspiration.

Figure 6-9 Example of plant and drainage material used in a typical green roof. ***Photo courtesy of US EPA***

- ***Rain Harvesting*** is the practice of capturing and storing rainwater for eventual reuse, most commonly for landscape irrigation purposes. Rain harvesting reduces the amount of stormwater that leaves the site. Rainwater is typically collected from rooftops in large cisterns or rain barrels. Rain harvesting provides property owners with an immediately available irrigation water source. The community benefits are substantial as the demands for irrigation water supplies can be significantly reduced.

- ***Downspout Disconnection*** is an inexpensive yet effective green infrastructure stormwater management practice. The purpose of disconnecting downspouts is to direct rooftop runoff away from ground-level impervious surfaces such as driveways and streets. This simple practice can significantly reduce the amount of runoff that enters the municipal stormwater system. If properly designed, downspouts can provide an excellent irrigation source for home lawns and gardens. Some municipalities throughout the country have instituted ordinances that require property owners to disconnect their downspouts.

- ***Permeable Pavements*** are road construction materials consisting of fewer fine particles, which provide more material void space enabling stormwater to infiltrate into the ground surface more easily. In terms of community-wide coverage, parking lots, roadways, and driveways account for one of the most extensive components of

impervious surface areas in our watersheds. Permeable pavements are an innovative way to reduce stormwater volumes and runoff rates.

- ***Planter Boxes, Rain Gardens, and Vegetated Swales*** are a diverse group of green infrastructure approaches that incorporate native landscaping to capture stormwater runoff from nearby impervious areas. These landscaping techniques enhance property aesthetics while improving water quality and in the case of vegetated swales and rain gardens to promote groundwater infiltration.

Figure 6-10 Example of a rain barrel used for residential irrigation purposes. ***Photo Courtesy of US EPA.***

Figure 6-11 This type of paver system allows water to infiltrate into the ground surface below. ***Photo courtesy of US EPA***

Neighborhood Scale Applications

- ***Green Streets*** involve a holistic approach to incorporating stormwater best management practices into the existing urban landscape along roadway corridors. Since roadways are one of the largest components of publicly owned space within local communities, this offers local governments one of the best opportunities to invest in green infrastructure practices. Individual design elements include street trees, permeable pavements, and infiltration and bioretention practices. Each roadway has unique implementation challenges and opportunities requiring corridor specific planning and design. Despite the varying design functions and appearance, the overall objectives of green streets are generally the same and include source control of stormwater runoff, limiting the conveyance of harmful pollutants, and restoring pre-development hydrologic characteristics.

- ***Pocket Wetlands*** are engineered systems designed to control stormwater volume and facilitate pollutant removal. Generally, pocket wetlands have less biodiversity than natural wetlands but still require a base flow to support the aquatic vegetation present. Pollutant removal in these systems occurs through the settling of larger solids and course organic material, microbial breakdown of pollutants, and also by uptake in the aquatic vegetation.

- ***Tree Planting*** provides numerous environmental and social benefits for local communities. With respect to stormwater management, trees are capable of intercepting rainfall which reduces the quantity and the rate at which rainfall reaches the ground surface. Trees are also very beneficial in reducing erosion rates by stabilizing

the soil substrate and holding soil in place. Trees also enhance the abilities of the soil to absorb stormwater and recharge the groundwater system. As mentioned earlier in this chapter, many communities in the Waccamaw region participate in the Tree City USA program co-sponsored by the South Carolina Forestry Commission. Maintaining an urban forestry program helps to enhance property values and community aesthetics while providing numerous benefits for local residents and wildlife.

Watershed Scale Applications

- ***Riparian Buffers*** are vegetated areas between stream shorelines and adjacent upland areas providing enhanced water quality protection for our river systems. Vegetative buffers provide similar water quality protection benefits around wetland areas as well. Having a sufficient vegetated buffer between surface waterbodies and actively utilized land areas has shown to be an effective means of reducing nutrient and pathogenic bacteria loads to our waterways. The vegetative materials help to stablilize stream banks, therefore minimizing the potential for soil erosion. Forested buffers also increase the shade along the shoreline providing additional benefits by keeping the surface water temperatures cooler, thereby improving the habitat for aquatic species. The effectiveness of a riparian buffer is often dependent on maintaining an adequate width of vegetated area. The general recommendation is to establish a vegetative buffer of at least 50 feet from the stream shoreline, where practicable. Vegetated buffers can provide similar benefits when they are established along roadway drainage ditches and residential and commercial detention/retention ponds, but should be limited to small shrubs and plants so that access to maintain the channels is not impeded.

Figure 6-12 Example of a green street. Beneficial features include a mature tree canopy and a vegetated curb extension which not only reduces the total area of impervious surface, but also collects and stores stormwater runoff from the roadway. *Photo courtesy of US EPA.*

Figure 6-13 Pocket wetlands can be designed to provide valuable outdoor amenities within a community. *Photo courtesy of US EPA*

Green Infrastructure Implementation Guidance

Fostering the utilization of green infrastructure stormwater management practices entails a long-term strategy which must focus on municipal infrastructure investments, public awareness, and the use of regulatory and incentive based mechanisms. The US EPA created the *Water Quality Scorecard: Incorporating Green Infrastructure Practices at the Municipal, Neighborhood, and Site Scales* as a reference document to assist local governments with developing strategies to implement green infrastructure practices in their communities. This section highlights a broad array of strategies to develop a holistic green infrastructure network on a local and watershed scale. A copy of the *Water Quality Scorecard: Incorporating Green Infrastructure Practices at the Municipal, Neighborhood, and Site Scales* can be accessed online at: http://www.epa.gov/smartgrowth/pdf/2009_1208_wq_scorecard.pdf

Objective #1: *Protect natural resources (including trees) and open space.*

This objective aims to protect significant tracts of critical lands and wildlife habitat. These land areas provide tremendous water quality benefits on a regional watershed scale by increasing infiltration and groundwater recharge, minimizing the impacts of erosion, and by protecting drinking water supplies. This objective also recognizes mature trees as an invaluable natural resource asset which help to reduce stormwater runoff rates and improve stormwater quality.

Implementation Tools and Policies

- Identify and map critical natural resource areas such as drinking water source areas, wetland areas, etc.
- Conduct periodic inventory surveys of tress on public lands and street right of ways to identify maintenance and planting needs as part of a local urban forestry program.
- Develop goals and objectives in the natural resources element of the comprehensive plan to call for the preservation of critical natural resource areas.
- Develop a community open space and parks plan.
- Establish a dedicated source of funding for open space acquisition through impact fees or local sales tax.
- Develop conservation subdivision ordinances to ensure that critical open space is protected on new development tracts.
- Revise land development regulations to include riparian buffer requirements of fifty feet, or to the greatest extent practicable, from all wetlands and streams.
- Provide open space credit for developers who incorporate green roofs into the building site design.
- Establish tree removal permit programs and require tree replacement provisions for trees that are removed during construction activities.
- Establish reduced setbacks or increased building density incentives for developers who exceed minimum tree preservation requirements.
- Adopt tree preservation credits as an alternative to meeting stormwater management requirements.

Objective #2: *Promote efficient, compact development patterns and infill.*

This objective promotes the reuse of existing developed land so that natural greenfield sites do not become developed unnecessarily. By minimizing the amount of total land that becomes developed within a community, there is a corresponding reduction in the amount of impervious surfaces within a watershed. This objective also encourages development on greenfield sites to be limited to areas that can be serviced by existing infrastructure such as water and sewer. Continued growth and economic development objectives can be achieved by promoting the development of mixed use districts. These types of development patterns typically decrease the amount of impervious surfaces by minimizing the need and demand for parking spaces.

Implementation Tools and Policies

- Develop an inventory of all brownfield and grayfield sites and provide redevelopment incentives such as density bonuses and expedited permit review.
- Establish higher density zoning districts in areas that have adequate water and sewer infrastructure capacity.
- Target vacant and underutilized lands as retrofit areas for the incorporation of green infrastructure practices.
- Adopt a transfer of development rights program to provide incentives for landowners to preserve valuable rural areas.
- Reduce impact fees for infill development based on less demand for new infrastructure.

- Develop concurrency ordinances which only allow development in areas where infrastructure such as centralized water and sewer service already exist.
- Identify areas in local comprehensive plans that may be suitable to higher density mixed-use districts.
- Review existing zoning ordinances and remove any existing barriers to mixed-use development in targeted districts within the community.
- Limit the use of auto-oriented services such as commercial drive-throughs in mixed use zoning districts.

Objective #3: *Design complete, smart streets that reduce overall imperviousness.*

Appropriate street design and transportation demand management strategies can be pursued within urban settings to meet the transportation needs of multiple users such as walkers, motorists, bicyclists and public transportation passengers. In turn, if effectively implemented, the total impervious surface area within a watershed can be significantly reduced by utilizing strategic green infrastructure practices to protect the water quality of runoff generated from streets, sidewalks, and parking lots.

Implementation Tools and Policies

- Encourage the expansion of alternative modes of transportation on a local and regional level in local comprehensive plans and transportation plans.
- Encourage the use of context-sensitive design transportation corridors in local comprehensive plans. Context-sensitive design can be used to narrow road widths and to identify key natural features such as mature trees along transportation corridors, thereby enhancing roadway aesthetics and providing stormwater management benefits.
- Identify street corridors within the street network that could be narrowed from 12-13 feet to 10-11 feet per travel lane. Work with SC DOT to accomplish this objective for roadways that are owned and maintained by the state.
- Eliminate the use of curb and gutter stormwater management systems within the roadway network where practical and replace them with green infrastructure elements such as roadside bioswales.
- Include green infrastructure feasibility and cost assessments in all new transportation improvement projects.
- Secure funding for green infrastructure improvements through state and federal transportation enhancement grant programs.
- Incorporate green infrastructure pilot projects as part of the local government's capital improvements plan for public facility and transportation improvement projects.
- Adopt regulations that require a minimum percentage of all parking lots, sidewalks, and roadways to be constructed with pervious pavement materials.

Objective #4: *Encourage the efficient provision of parking.*

This objective focuses on specific stormwater management issues related to parking facilities. The objective aims to utilize structural approaches such as the utilization of pervious pavement materials in parking lot areas and non-structural approaches such as reducing the minimum parking space provision for businesses and residential developments.

Implementation Tools and Policies

- Require the installation of bicycle amenities in exchange for a reduction in required vehicular parking spaces, especially in areas such as mixed-use districts.

- Allow flexibility in parking space requirements by permitting on-street parking and shared parking to count towards total requirements.
- Allow developers within certain districts to make in-lieu payments for parking. Collected fees can be dedicated to the investment of public parking areas within the community.
- Adopt parking lot landscaping provisions such as the preservation of existing trees, minimum interior landscaped island areas, and the utilization of specific plant species to meet landscaping requirements.
- Reduce total parking lot area by providing additional compact car spaces and reduce drive aisle widths as mechanisms to reduce the total parking lot impervious surface area.
- Require use of green infrastructure practices such as tree planting, rain gardens, and bioswales, to control the amount of stormwater runoff leaving parking lot sites.
- Reduce parking requirements for developers in mixed-use zoning districts and other areas served by multiple modes of transportation to reflect the decreased use in automobiles.

Objective #5: *Adopt Green Infrastructure stormwater management provisions.*

Green infrastructure has proven to be an effective approach to managing stormwater runoff and in ensuring the protection of water quality in our rivers and streams. In addition, green infrastructure can in many instances be more cost effective than traditional stormwater infrastructure practices. Green infrastructure can also provide numerous other community benefits such as enhanced community aesthetics, reduced heat island effects, and a secondary source of non-potable water to meet landscaping irrigation needs. This objective promotes the need to enhance public awareness of the benefits of green infrastructure and provides guidance on how local governments can encourage the use of these practices within their communities.

Implementation Tools and Policies

- Develop public education and workshop activities to provide property owners information about the benefits of green infrastructure, the various applications of green infrastructure, and the maintenance requirements of each selected green infrastructure practice.
- In local comprehensive plans, identify areas within the community that could be targeted for green infrastructure retrofit projects.
- Credit green infrastructure practices towards meeting minimum requirements for stormwater runoff controls.
- Reduce stormwater utility fees for developments that incorporate green infrastructure practices.
- Provide expedited permit review for developments that incorporate green infrastructure practices.
- Incorporate routine inspection provisions for all approved green infrastructure projects to ensure that property owners are properly maintaining each project site.
- Institute a recognition program to highlight green infrastructure projects that are implemented in the local community. This would provide models and examples showcasing the benefits of green infrastructure and to encourage the expanded use of these stormwater management strategies.
- Develop a concise maintenance plan for green infrastructure projects so that maintenance responsibilities and timelines are clearly outlined.

Local Case Studies

Clemson's Carolina Clear program has developed and maintained an online Low Impact Development atlas, which highlights stormwater best management practices that have been implemented in the state of South Carolina. This tool enables stormwater managers, planners, and developers to share specific information about LID projects to serve as models for addressing community stormwater and growth management issues. The types of LID practices which are

showcased in the atlas include bioswales, bioretention rain gardens, rain harvesting projects, stormwater wetlands, green roofs, permeable pavements, and water conservation projects.

The South Carolina Low Impact Development Atlas is integrated into a national database sponsored by the Nonpoint Education for Municipal Officials network. Communities within the Waccamaw region have actively participated in this project and have submitted a total of 24 projects into the database as of 2011. **Table 6-6** provides a list of the projects currently included in the South Carolina Low Impact Development Atlas. The South Carolina Low Impact Development Atlas can be viewed at: http://www.clemson.edu/public/carolinaclear/lidmap/

Table 6-6 South Carolina Low Impact Development Atlas

Site	Location	Type of LID Application	Date of Installation
Georgetown High School	2500 Anthuan Maybank Drive, Georgetown, SC 29440	Bioretention/ Rain Garden	2008
Georgetown Chamber of Commerce	1001 Front Street. Georgetown, SC 29440	Permeable Pavement	2005
Clemson Baruch	1 Hobcaw Road. Georgetown, SC 29440	Bioretention/ Rain Garden	2009
Hobcaw Barony	22 Hobcaw Road. Georgetown, SC 29440	Permeable Pavement	2007
Oyster Landing- North Inlet Winyah Bay NERR	Georgetown, SC 29440	Erosion Control	2007
Ricefields Residential Development	Pawleys Island, SC 29585	Stormwater Wetlands	2000
Waccamaw Elementary School	1364 Waverly Road, Pawleys Island, SC 29585	Bioretention/ Rain Garden	2010
Brookgreen Gardens	1931 Brookgreen Drive. Murrells Inlet, SC 29576	Permeable Pavement	N/A
Murrells Inlet Bike Path	Murrells Inlet, SC 29576	Permeable Pavement- 300 ft section	2008
Burgess Elementary School	9645 Scipio Lane, Myrtle Beach, SC 29588	Bioretention/ Rain Garden	2008
Moss Park	Myrtle Beach, SC 29588	Stormwater Wetlands	2005
Yaupon Park	Surfside Beach, SC 29575	Permeable Pavement	2009
Magnolia Lake	14th Avenue N. Surfside Beach, SC 29575	Vegetated Shoreline Stabilization	2008
Fire Station #14	1170 Howard Parkway, Myrtle Beach, SC 29577	Bioretention/ Rain Garden	2009
Myrtle Beach Train Depot	851 Broadway Street. Myrtle Beach, SC 29578	Bioretention/ Rain Garden	N/A
Socastee High School	4900 Socastee Boulevard. Myrtle Beach, SC 29588	Bioretention/ Rain Garden	2008
Habitat Park	Cabana Street and Pine Tree Lane, Briarcliffe Acres, SC 29572	Native vegetation landscaping	N/A
Habitat Park	Cabana Street Briarcliffe Acres, SC 29572.	Bog Garden/ Riparian Buffer	2010
Coastal Carolina University- Center for Marine and Wetlands Studies	1270 Atlantic Avenue Conway, SC 29526	Bioretention/ Rain Garden	2006
Waccamaw Elementary School	251 Claridy Road. Conway, SC 29526	Bioretention/ Rain Garden	2010
Horry County Administration Building	1301 Second Avenue Conway, SC 29526	Bioretention/ Rain Garden	2010
Conway High School	1605 Horry Street Conway, SC 29528	Bioretention/ Rain Garden	2008

Note: *Current as of May 2011*
Source: *South Carolina Low Impact Development Atlas, Carolina Clear- Clemson University*

Funding Opportunities

Section 319 Non-point Source Management Program

The 1987 amendments to the federal Clean Water Act established the Section 319 Nonpoint Source Management Program in the United States. The aim of this program is to grant funding opportunities to state and local government agencies to provide technical, educational, training, and project implementation assistance to address non-point source pollution problems. Grant awards cover up to 60% of the total project costs, with the remaining 40% being covered by the grant applicant. SC DHEC gives highest priority to projects that are implemented in a watershed with an approved TMDL. Section 319 grant projects are also intended to address non-point source pollution outside of existing designated MS4 permit boundaries.

Section 319 grants have been utilized to implement non-point source management projects in the Waccamaw region in the past. Between 1999-2003 Coastal Carolina University engaged in a non-point source management project in the Kingston Lake and Crabtree Canal Watersheds in Horry County. The aim of the project was to identify and mitigate fecal coliform and low dissolved oxygen problems attributable to non-point sources of pollution. The project included the retrofit of an existing detention pond into a more natural pond/wetland system. Significant monitoring and educational components were also included as part of the scope of this project. This project successfully reduced fecal coliform bacteria and Total Suspended Solid loads to Kingston Lake and was one project in an ongoing effort to address long-term water quality concerns in the Waccamaw River watershed. Watershed stakeholders still actively promote public awareness of watershed management needs through the Kingston Lake Environmental Awareness Network (KLEAN). More information about their efforts can be found online at: http://www.coastal.edu/wwa/klean/

The Kingston Lake Section 319 grant project serves as a great example of how to address problems associated with non-point sources of pollution in the Waccamaw region. There are waterbodies with existing TMDLs within the Waccamaw region that may be eligible for Section 319 grant support. This would provide great benefits to our region's water quality management efforts by providing a focused approach at addressing specific known threats of non-point source pollution.

South Carolina Clean Water State Revolving Fund

The South Carolina Clean Water State Revolving Fund (SFR) was established and authorized via the 1987 amendments to the federal Clean Water Act. The aim of the fund is to assist project sponsors with the financing of Publicly Owned Treatment Works and non-point source management activities. The SC DHEC office in conjunction with the State Budget and Control Board Office of Local Governments processes and issues loans to fund eligible projects.

South Carolina utilizes a Priority Ranking System to evaluate eligible projects. Recently the state has decided to evaluate capital projects for municipal wastewater treatment facilities and non-point source pollution prevention projects on an equal basis, allowing the Clean Water State Revolving Fund program to focus on water quality issues as comprehensively as possible. In fiscal year 2009, only four of the forty-two projects listed on the SRF Intended Use Plan were non-point source pollution related projects. It is important for non-point source management entities to be aware of this potential funding source as they implement projects to address stormwater runoff issues in their communities. The State of South Carolina was a recipient of American Recovery and Reinvestment Act stimulus funding. $40,148,200 was passed onto the Clean Water State Revolving Fund. One of the main objectives of the ARRA funding is to promote and encourage "green infrastructure" projects. 20% of all ARRA funding, approximately $8,000,000, will be dedicated to green infrastructure projects. This is a great incentive to promote and encourage the implementation of innovative non-point source water quality management strategies within our local communities.

For general information about the SC Clean Water State Revolving Fund visit the SC DHEC website at: http://www.scdhec.gov/environment/water/srf.htm For more information about green infrastructure funding opportunities through the SC Clean Water State Revolving Fund and eligibility requirements refer to the following weblink: http://www.scdhec.gov/environment/water/docs/srf_qpr.pdf

US Army Corps of Engineers- Planning Assistance to States Program. Through the Water Resources Development Act, the US Army Corps of Engineers awards grants to states and local governments for the purpose of developing comprehensive plans for the utilization and conservation of water and related land resources.

More information about this grant opportunity can be found online at:
http://www.sac.usace.army.mil/?action=programs.support

US EPA Wetlands Program Development Grants. This grant program is designed to foster the acceleration of research, training, demonstrations, and studies relating to the causes, prevention, and elimination of water pollution. The program has three established priority areas including developing a comprehensive monitoring and assessment program, improving the effectiveness of compensatory mitigation, and refining the protection of vulnerable wetlands and aquatic resources.

Additional information about this grant opportunity can be found online at US EPA's website at:
http://water.epa.gov/grants_funding/wetlands/grantguidelines/index.cfm

SC DHEC-OCRM, Capacity Building Grant for Local Governments. One of the many responsibilities of SC DHEC-OCRM is to coordinate activities to address non-point source pollution water quality issues in coastal areas through the Federal Coastal Nonpoint Program. One of the ways SC DHEC-OCRM supports efforts to address coastal non-point source issues is through the Capacity Building Grant for Local Governments.

Additional information on programs administered by SC DHEC- OCRM to address water quality issues in coastal waters can be found online at: http://www.scdhec.gov/environment/ocrm/water_quality.htm

The programs mentioned in this section have led to the implementation of many successful water quality management projects in the Waccamaw region. It is only a partial list of all the available funding sources focused on water quality management. A current and regularly updated list of grant programs administered through various federal agencies can be found online at www.grants.gov

NON-POINT SOURCE POLLUTION MANAGEMENT GOALS AND RECOMMENDATIONS

The following section provides a list of goals and corresponding recommendations with respect to non-point source pollution management efforts in the Waccamaw region. As discussed throughout this chapter, non-point sources of pollution can have tremendous impacts on the water quality of our local beaches, estuaries, streams, and rivers. Management efforts must be directed at several potential pollution sources within our watersheds in both urban and rural areas. These goals reflect the range of activities and land uses that must be addressed as part of a comprehensive non-point source pollution management framework. Many of these goals focus on emerging stormwater management strategies, such as green infrastructure. In addition, several recommendations highlight the need to coordinate efforts amongst all relevant stakeholders to develop both structural and non-structural solutions to manage stormwater runoff and other types of non-point source pollution.

Goal One: Government entities will lead the effort to address non-point source pollution as a serious water quality issue in the Waccamaw region by implementing projects and management strategies to minimize impacts associated with non-point source pollution. ***Recommendations include:***

- Pursue projects and initiatives that support the goals outlined in SC DHEC's South Carolina Non-point Source Management Plan. This document can be accessed online at: http://www.scdhec.gov/environment/water/docs/nps.pdf
- Encourage close collaboration between point-source and non-point source management agencies to ensure that regional water quality issues are being addressed thoroughly and comprehensively.
- Pursue all available funding opportunities to address non-point source related problems as part of Total Maximum Daily Load projects within the Waccammaw region. Section 319 grant funding should be pursued in areas outside of the MS4 boundaries that are covered within the boundaries of a TMDL in the Waccamaw region.
- Ensure that all available structural stormwater filtration devices are evaluated when considering stormwater construction projects.
- All MS4 jurisdictions, including SC DOT, are responsible for maintaining the roadways throughout the Waccamaw region. Strive to implement innovative stormwater best management practices in all scheduled roadway maintenance and improvement projects, where appropriate. Establishing vegetated buffers along roadway drainage ditches is one example of a practice that can be implemented along linear infrastructure corridors such as roadways.
- Continue to share knowledge with nearby communities on the effectiveness of various non-point source pollution management techniques that have been utilized in the region. In particular, take advantage of the findings from projects conducted by local research institutions including Coastal Carolina University, North Inlet-Winyah Bay NERR, and the Belle W. Baruch Foundation.
- Direct a specific focus on incorporating stormwater best management practices into linear projects such as utility installation and roadway corridor improvement projects.
- Ensure that water quality monitoring remains an integral investigative watershed management tool in identifying non-point source pollution problems in the Waccamaw region.

Goal Two: Facilitate the implementation of innovative stormwater management practices such as green infrastructure and Low Impact Development. Local governments should make the case that green infrastructure and Low Impact Development is a viable economical alternative to traditional stormwater management practices. ***Recommendations include:***

- Strive to implement Low Impact Development best management practices at community facilities, where appropriate, within each of the local jurisdictions in the Waccamaw region. Utilize these sites as public demonstration sites for proper design and implementation criteria.
- Pursue the development of a coastal Low Impact Development manual that assists stormwater managers and local decision makers in implementing stormwater management strategies that help to minimize water quality impacts commonly associated with urban development and increased impervious surfaces. A Low Impact Development manual should include engineering schematics that are suitable to coastal environmental conditions unique to the South Carolina coast.
- Revise local ordinances to allow and encourage the use of innovative best management practices and designs consistent with green infrastructure and Low Impact Development principles.

- Continue to encourage local stormwater managers to contribute Low Impact Development and green infrastructure projects to Clemson's Carolina Clear SC Low Impact Development Atlas program.
- Determine and implement a viable mechanism to ensure that green infrastructure projects that are constructed or established at a development site are protected indefinitely. Develop enforcement procedures designed to ensure that credited green infrastructure projects are properly maintained on a routine basis.
- Revise stormwater utility fee structures to provide discounts to property owners who incorporate green infrastructure practices into existing and new developments.
- Consider providing development incentives such as expedited permit review, permit and impact fee reductions, and floor/ area ratio density bonuses, for property owners who incorporate green infrastructure strategies into their site designs.
- Create tax incentives for installing Low Impact Development practices on residential and commercial properties.
- Encourage homeowners to use rain barrels by selling them at a reduced cost and offering installation assistance.
- Encourage homeowners to participate in initiatives such as Clemson's Carolina Yard and Neighborhood program, which focuses on the use of native landscaping and the efficient use of water, pesticides, and fertilizers to minimize impacts on local water resources. More information about this program can be found online at: http://www.clemson.edu/extension/natural_resources/water/carolina_yards/
- In partnership with planning staff at local governments, develop a list of areas to target for the establishment and maintenance of riparian buffers on a regional level.
- Continue to provide educational workshops and technical assistance to engineers, developers, and homeowners on LID and green infrastructure design and maintenance guidance.

Goal Three: Identify and actively address water quality issues associated with forestry related activities in the Waccamaw region. ***Recommendations include:***

- Promote and expand forestry management training programs such as the Best Management Practice Courtesy Exam program offered by the South Carolina Forestry Commission. Encourage local forestry professionals to continue to implement the South Carolina Forestry Commission best management practices at harvesting sites in the Waccamaw region.
- Utilize information gathered by the South Carolina Forestry Commission best management practices monitoring program to assess the level of compliance of forestry related BMPs and to direct appropriate education and outreach resources to ensure that BMPs are being implemented.
- Partner with timber harvesting site owners to assess the feasibility of preserving key forested areas to provide critical riparian buffer areas to address watershed level water quality impairment issues.
- Encourage local forestry landowners to participate in volunteer forestry certification programs such as the Sustainable Forestry Initiative Program and the Forest Stewardship Council.
- Encourage local communities to continue to participate in the Tree City USA program and other urban forestry initiatives sponsored by the South Carolina Forestry Commission.

Goal Four: Continue to work with local farmers and relevant management agencies such as the United States Department of Agriculture to identify and address all agricultural non-point source pollution concerns. ***Recommendations include:***

- Continue to monitor trends within agricultural based industries in the Waccamaw region by regularly reviewing land cover data and data published by the USDA Ag Census.

- Identify potential non-point source pollution management projects at local agriculture sites that may be eligible for Section 319 grant funding. Historically, agricultural runoff projects, such as riparian buffer establishment, have accounted for nearly forty percent of all Section 319 grant fund awards.
- Work with local farmers to pursue opportunities to participate in conservation and stewardship initiatives administered by the USDA Natural Resources Conservation Service.

Goal Five: Actively address non-point source pollution problems associated with boating and marine related activities.
Recommendations include:

- Partner with SCDHEC-OCRM and the South Carolina Marine Association to encourage local marinas to participate in the SC Clean Marina Program and institute measures to reduce non-point sources of pollution from their marine activities and operations.
- Identify popular recreational boating areas that are in need of boat septage pumpout stations and pursue funding sources such as the Clean Vessel Act Grant program to install them at appropriate marinas throughout the Waccamaw region.

This Page Has Been Left Blank Intentionally

Chapter Seven- Groundwater Management

INTRODUCTION

In addition to instituting management practices to protect the quality of local surface waterbodies, it is critical to ensure that our groundwater resources are safeguarded as well. The groundwater system is hydraulically interconnected with the surface water system and fluctuates according to seasonal weather patterns, water withdrawals, and drought conditions. Groundwater flow is dependent on the underlying soil and bedrock substrates. Usable groundwater sources are typically withdrawn from soil and bedrock formations known as aquifers. The three accessible aquifers in coastal South Carolina are the Pee Dee, Black Creek, and Tuscaloosa aquifer systems.

The close interface between the land surface and our precious groundwater system requires water resource managers to reduce the susceptibility of pollutant contamination. SC DHEC has established a classification and water quality standards system to protect the uses and environmental health of the groundwater resources in the State of South Carolina. **Table 7-1** provides an overview of the groundwater classification system in the state.

Table 7-1 South Carolina Groundwater Classifications and Standards

Water Classification	Description	Standards
Class GA	Considered highly vulnerable because of the hydrological characteristics of the areas under which they occur and are characterized as either irreplaceable or ecologically vital to a particular watershed.	A. Treated wastes, toxic wastes, deleterious substances, or constituents thereof- **NONE ALLOWED.**
Class GB	Include ground waters of the state which meet the definition of underground sources of drinking waters, unless otherwise classified.	A. Inorganic Chemicals- **Maximum contaminant levels as set forth in R. 61-58, State Primary Drinking Water Regulations.** B. Organic Chemicals- **Maximum contaminant levels as set forth in R. 61-58, State Primary Drinking Water Regulations.** C. Man-made radionuclides, priority pollutant volatile organic compounds, pesticides, herbicides, polychlorinated biphenyls, any other synthetic organic compounds not specified above, treated wastes, thermal wastes, deleterious substances, colored wastes or other wastes or constituents thereof- **Not to exceed concentrations or amounts such as to interfere with use, actual or intended, as determined by SC DHEC.**
Class GC	Not considered a potential source of drinking water and of limited beneficial use.	A. Treated wastes, toxic wastes, deleterious substances, or other constituents thereof- **None which interfere with any existing use of an underground source of drinking water.**

Source: *SC DHEC, 2008 R.61-68, Water Classifications and Standards*

GROUNDWATER ISSUES AND MANAGEMENT PROGRAMS

The first step in developing an effective groundwater management strategy is to identify potential sources of contamination. This allows water resource managers to institute measures to minimize the risks of contamination associated with the respective pollutant source. The level of contamination susceptibility varies substantially and is highly dependent on the specific land use activity and the subsurface geologic hydraulic characteristics in the area of interest. The ultimate objective of this assessment is to evaluate the public health risk and environmental threats of all potential sources of groundwater contamination. The following section provides a brief description of the most common sources of groundwater contamination.

Landfills- Solid waste disposal sites produce a leachate byproduct over time which can contain high concentrations of contaminants. Depending on the type of waste collected at the landfill, the leachate may contain organic compounds, nutrients, and metals. Proper management of leachate byproducts at landfill sites is critically important in order to protect groundwater resources.

Farmlands- Agricultural land uses often entail the application of fertilizers and pesticides. Fertilizers are composed of high concentrations of nutrients such as nitrogen and phosphorus. Nitrogen in particular can easily migrate through the groundwater system and can pose health risks to communities dependent on public groundwater supplies. Pesticides contain many synthetic organic compounds such as diazonin, flourene, and benzene.

Urban Stormwater- The primary concern related to stormwater runoff is its impact on surface water quality. Runoff that is infiltrated through the soil medium prevents most pollutants from impacting groundwater systems. However, some types of contaminants such as various metals, organic compounds, petroleum-based hydrocarbon residuals, and nitrates can migrate into the groundwater zone and threaten the quality of groundwater resources.

Drainfields- The common contaminant concerns related to on-site wastewater treatment sites include nitrogen, sodium, and chlorinated organic compounds.

Spills and Leakage- The most widespread source of groundwater contamination comes from accidental or illicit spills and leakage from underground storage tanks or pipelines. The contaminants associated with spills and leaks vary significantly to include cleaning compounds, petroleum products, organic compounds, and metals.

SC DHEC has drafted an inventory of known groundwater contamination sites throughout the state. The list of contaminated sites in the Waccamaw region is provided in **Appendix G.**

SC DHEC oversees a groundwater monitoring program which provides background water quality and geochemistry reference data of groundwater resources in South Carolina. More information regarding SC DHEC's Ambient Groundwater Monitoring Network is provided in **Chapter Nine- Water Quality Monitoring**. In addition, groundwater monitoring wells are installed at landfills, wastewater land application sities, and at industrial sites as a detection mechanism for potential incidents of groundwater contamination. Another important groundwater management strategy is to identify groundwater recharge zones, which are land areas that are highly permeable soil and rock formations, providing direct pathways for water to drain into the underground aquifer system. Minimizing land use activities that pose contamination risks should be avoided in known groundwater recharge zones.

The next section includes a profile of important groundwater management programs administered in the State of South Carolina.

Source Water Assessment and Protection Program

As part of the 1996 amendments to the federal Safe Drinking Water Act, the federal government now requires states to develop source water assessments as a means to focus greater efforts at pollution prevention as a drinking water supply protection strategy. The South Carolina Source Water Assessment and Protection Program has been established as the framework for carrying out this water resource management objective.

A Source Water Assessment is established for public water supply systems that provide service to at least 15 connections and 25 people for a minimum of 60 calender days per year. A Source Water Assessment includes a delineation of land area, referred to as the Source Water Protection Area. This protection area is defined as the land area that contributes water to the intake of a particular water supply system. There are separate methodologies for determining the boundaries of a Source Water Protection Area for groundwater and surface water sources of drinking water supply. An assessment includes a full inventory of all potential contaminant sources, including various land uses and site-specific activities that could potentially release contaminants of concern within the Source Water Protection Area. Finally, the Source Water Protection Assessment provides a susceptibility analysis that determines the likelihood of water supply impacts associated with pollutant contamination in the protection area. A high, moderate, or low susceptibility ranking is provided for each identified potential contaminant source. As part of the susceptibility analysis, the vulnerability of a groundwater source is also evaluated. A vulnerability assessment provides guidance on the hydrogeologic characteristics of each groundwater source. Vulnerability varies based on several natural and intrinsic factors, including whether an aquifer is deep or shallow and whether an aquifer is confined, semi-confined, or unconfined. A list of Source Water Assessment reports in Horry, Georgetown, and Williamsburg Counties is provided in **Appendix F**.

There are eight classifications of potential contaminants that must be accounted for in a Source Water Assessment report. The classification categories are listed below:

1. Volatile Organic Compounds
2. Petroleum products
3. Metals
4. Nitrates
5. Pesticides/herbicides
6. Pathogens
7. Radionuclides
8. Undetermined

The South Carolina Source Water Assessment and Protection Program provides critically important water quality information to assist local water resource managers in efforts to protect our region's drinking water supply. The identification of potential contaminant threats allows resource managers to institute protective measures and treatment technologies to ensure that a high quality and safe supply of drinking water is distributed through each public water supply system. An important reality to recognize is that although Source Water Assessment and Protection evaluations are invaluable water quality management tools, it is still necessary to have a thorough and sufficient contingency response plan in place in case an unforeseen accident results in a contamination incident in one of our local Source Water Protection Areas. Contingency plans should entail a full assessment of plausible emergency scenarios in our local watersheds and an identification of suitable alternative water supply resources to serve the affected distribution system.

For more information about the Source Water Assessment and Protection Program administered by SC DHEC, visit http://www.scdhec.gov/environment/water/srcewtr.htm

South Carolina Groundwater Contamination Inventory

Beginning in 1980, SC DHEC has conducted inventories to identify locations of known groundwater contamination. The inventory provides an assessment of the type of contaminant, the source of contaminant, and a status on the investigation/remediation process at the contamination site. Sites are designated as contaminated based on the maximum contaminant level provisions for inorganic and organic compounds set forth in the State Primary Drinking Water Regulations. In the 2008 inventory report, SC DHEC identified a total of 412 groundwater contamination sites in the Waccamaw region. The predominant source of groundwater contamination identified throughout the state are from underground storage tank facilities. Petroleum products were the most common type of contaminant found at the groundwater contamination sites. A complete list of all of the groundwater contamination sites identified in the 2008 South Carolina Groundwater Contamination Inventory that are located in the Waccamaw region are provided in **Appendix G.**

GROUNDWATER MANAGEMENT GOALS AND RECOMMENDATIONS

The following section provides a list of goals to enhance the protection of the groundwater resources in the Waccamaw region. Some of the goals address groundwater contamination problems that already exist and have been identified in the Waccamaw region. Other goals focus on increasing our knowledge and understanding of local groundwater resources and to institute measures to prevent groundwater contamination problems within our region.

Goal One: Encourage local governments to incorporate an assessment of groundwater resources into their land use decision making processes. ***Recommendations include:***

- Conduct an assessment of potential groundwater contamination sources based on various land uses and activities within the community.
- Conduct a comprehensive inventory assessment of groundwater recharge zones similar to developing a wetland inventory throughout the Waccamaw region.

Goal Two: Continue to develop and execute remediation strategies at sites listed on SC DHEC's groundwater contamination inventory. ***Recommendations include:***

- Prioritize management resources to focus on contamination sites that pose the largest risk to the environment and to public health.
- Proactively work with facility owners to discuss necessary steps to remediate contamination problems.
- Provide adequate information to adjacent property owners and the general public who may be impacted by known groundwater contamination issues.

Goal Three: Develop emergency response plans in cases of accidental spills that may impact local groundwater resources and threaten local drinking water supplies. ***Recommendations include:***

- Ensure that appropriate facility managers and the general public are aware of the proper authorities to contact when an accident occurs or a contamination spill is noticed.
- Emergency response plans should entail regional objectives to ensure that affected communities have backup supplies of potable drinking water.
- Regularly evaluate Source Water Assessments for all drinking water supplies in the Waccamaw region.

Goal Four: Continue to invest in sufficient groundwater monitoring and testing resources to ensure that groundwater quality is being protected. ***Recommendations include:***

- Conduct an annual water quality test for nitrate and bacteria at all drinking water supply wells.
- Regularly review and collate groundwater monitoring data at sites and facilities that are required to conduct groundwater monitoring such as wastewater land application sites, landfills, and certain industrial sites.
- Utilize information provided by ongoing groundwater monitoring and research activities conducted by the USGS, SC DHEC, and other entities to assist in groundwater management decision making.
- Maintain research and invest in monitoring resources to fully examine the impacts of saltwater intrusion on surface and groundwater resources.

Goal Five: Ensure that residential and agricultural landowners are aware of appropriate irrigation and fertilizer application practices to prevent contamination issues in our groundwater systems.

This Page Has Been Left Blank Intentionally

Chapter Eight: Economic Development

INTRODUCTION

The state of the local economy is a major determinant of the quality of life experienced by residents throughout the Waccamaw region. Economic conditions can be influenced by a wide range of factors on a local, regional, state, and national level. Economic development initiatives often require partnerships among several government agencies and private enterprises. When pursuing new economic growth opportunities it is important to examine the full context of the proposed project and to consider all possible negative externalities that may impact the natural environment or affect public health.

Water has been recognized throughout the world as an economic good by international organizations such as the United Nations World Water Assessment Programme. In the 1992 Dublin Statement on Water and Sustainable Development, Principle No. 4 pronounces ***"Water has an economic value in all its competing uses and should be recognized as an economic good. Within this principle, it is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price. Past failure to recognize the economic value of water has led to wasteful and environmentally damaging uses of the resource. Managing water as an economic good is an important way of achieving efficient and equitable use, and of encouraging conservation and protection of water resources"***

This chapter recognizes the important economic value of the water resources that are present in the Waccamaw region. These water resources add significant cultural, social, and economic value to all of our communities and must be managed appropriately to ensure that their long-term environmental health is properly maintained.

Economic Context of the Waccamaw Region

When examining the context of the natural environment in the Waccamaw region, it is easy to recognize that the local beaches, scenic rivers, and pristine tidal estuaries are all vital assets to the regional economy. The tourism based economy of the Grand Strand region is driven primarily by the numerous recreational opportunities all along the extensive beaches and waterways. In order for the Grand Strand area to continue to thrive as a tourism destination, the region's water resources must be properly managed to ensure that water quality standards are being met. Other major water related industries within the Waccamaw region include recreational boating, sport and commercial fishing, and shellfish harvesting.

Figure 8-1 Hotel and condominium developments line the coast of popular beach destinations such as Myrtle Beach

Communities in the Waccamaw region located away from the immediate coastline also have a significant economic stake in maintaining high water quality. Georgetown County, Williamsburg County, and Horry County all have industrial sites that are significant contributors to the economic base of the region. Industrial point-source dischargers are dependent on the assimilative capacity of receiving waterbodies. NPDES permit restrictions are in place based on the pollutant load and Biochemical Oxygen Demand that the receiving waterbody can assimilate without exceeding water quality standards for their intended use. Future industrial development in the Waccamaw region will be dependent on the availability of additional assimilative capacity in our waterways. Local governments should promote industrial development that utilizes the best available technologies to reduce point source pollutant loads in our surface

waterbodies. Local wastewater utility providers also have a critical role in providing wastewater treatment services to potential industrial customers.

Economic Value of the Water Resources in the Waccamaw Region

Ensuring that the water quality standards of our region's waterbodies are met requires a significant investment in pollution abatement infrastructure and initiatives, such as wastewater treatment facilities, restoration project work to improve impaired waterbodies, and public education to help prevent water pollution. To ensure that the proper investments of limited financial resources are being made, it is critically important to determine which management efforts are most likely to achieve our region's water quality goals. Low cost measures to maintain and improve water quality should be sought and the initial occurrence of pollution in our waterways should be minimized as much as possible to avoid costlier mitigation and cleanup measures later on. Direct benefits of water quality management efforts include enhanced recreational water activities and reduced exposure to in-stream contaminants. Indirect benefits include enhanced near-stream recreational activities and aesthetics, and a general improvement in the quality of life for people who work or live near local waterways. Finally there are several diversionary benefits of investing resources in water quality management, especially related to the costs of treating drinking water supplies.

The Center for Watershed Protection has developed a general assessment of the expected economic benefits of instituting several categories of watershed management tools. **Table 8-1** below provides a summary of the economic benefits of each of these watershed protection strategies.

Table 8-1 Economic Benefits of Instituting Watershed Protection Practices

Watershed Protection Tool	Economic Benefit
Watershed Planning- zoning tools, growth management strategies, source water protection	➢ Income from fisheries, agriculture, industry, and recreation and tourism ➢ Reduction of drinking water costs, health care costs, and watershed restoration costs.
Land Conservation- forest conservation, wetland protection, preservation of parks and open space	➢ Income from recreation and tourism and increased property values ➢ Reduction of energy costs, health care costs, flood control costs, and stormwater management costs
Aquatic Buffers- resource protection areas, stream buffers	➢ Income from fishing and increased property values ➢ Reduction of flood control costs, stormwater management costs, and watershed restoration costs.
Better Site Design- reduction in impervious surface coverage, tree preservation, cluster development	➢ Income from increased property values ➢ Reduction in infrastructure construction and maintenance costs.
Erosion and Sediment Control- stream channel protection, clearing and grading practices, construction site erosion and sediment control	➢ Income from marine and port activities and increased property values. ➢ Reduction of drinking water treatment costs, construction costs, restoration costs, and dredging costs associated with navigation channel maintenance.
Stormwater Treatment Practices- stormwater regulations, floodplain protection	➢ Income from increased property values ➢ Reduction in flood control and stormwater infrastructure costs.
Non-stormwater Discharges- point source controls, septic system regulations	➢ Reduction of pollution-related public health costs and watershed restoration costs.
Watershed Stewardship Initiatives- public education and awareness, water quality monitoring, pollution prevention programs.	➢ Reduction in watershed restoration costs.

Source: *The Economic Benefits of Protecting Virginia's Streams, Lakes, and Wetlands. Virginia Department of Conservation and Recreation. Prepared by: Center for Watershed Protection*

ECONOMIC DEVELOPMENT OPPORTUNITIES

As discussed in the previous section, the local water resources provide the economic foundation for the entire region. The key to ensuring that our local water resources continue to provide economic benefits to local communities and to the region as a whole is to manage them in a sustainable way. This section highlights a few broad strategies to incorporate stewardship practices of local water resources as part of an overall economic development strategy for the Waccamaw region.

Ecotourism

The tourism economic sector has become increasingly more diversified and focuses on a number of specific types of activities that draw visitors to a particular area. Ecotourism is defined by the International Ecotourism Society as "Responsible travel to natural areas that conserves the environment and improves the well-being of local people". The International Ecotourism Society also promotes the following principles which help to define this burgeoning sector of the tourism economy.

- Minimize impact.
- Build environmental and cultural awareness and respect.
- Provide positive experiences for both visitors and hosts.
- Provide direct financial benefits for conservation.
- Provide financial benefits and empowerment for local people.

Given the tremendous wealth of natural resources within the Waccamaw region, there are several opportunities to promote the growth of ecotourism throughout the area. The following is a description of an existing project along with some additional recommendations for making ecotourism a viable component of the region's overall tourism development strategy.

Waccamaw River Blue Trail- A new recreational opportunity and ecotourism development project within the Waccamaw region is the Waccamaw River Blue Trail, organized by American Rivers and its local partners, the Winyah Rivers Foundation and the Pee Dee Land Trust. The aim of this project is to help showcase the Waccamaw River as a precious community asset and to support conservation efforts to protect the natural character of the watershed's vibrant ecosystem.

The Waccamaw River Blue Trail is designed as a recreational attraction similar to a hiking trail, where visitors can access the river at several locations and explore and learn about the waterway through a wayfinding system and interpretive map. Current plans aim to extend the Waccamaw River Blue Trail from the headwaters in Southeastern North Carolina to Winyah Bay in Georgetown County. Experiencing the natural scenery of the river fosters increased stewardship of this invaluable water resource. The Waccamaw River Blue Trail is an excellent addition to the wide variety of recreational opportunities that already exist for both residents and tourists in the Waccamaw region. It should serve as a model for the development of future ecotourism attractions in the Waccamaw region.

More information about the Waccamaw River Blue Trail can be found online at: http://www.americanrivers.org/our-work/protecting-rivers/blue-trails/waccamaw.html

Southeast Coast Saltwater Paddle Trail- This effort is being coordinated by the National Park Service in partnership with several stakeholder groups in states throughout the Southeast. This multi-state project will ultimately extend from

the western portions of the Florida panhandle to the northern coast of Virginia. The existing Florida Circumnavigation Saltwater Paddling Trail and the Captain John Smith National Historic Trail in the Chesapeake Bay will be anchor points for the larger regional paddle trail system. This project is still in the initial planning and conceptual development stages and will ultimately include paddle trail access and camping facility improvements. A comprehensive informational website is now under development.

Gateway Communities- Several agencies and organizations including the National Park Service and the National Geographic Center for Sustainable Destinations, have spearheaded efforts focused on providing planning and development guidance to communities that are located near or adjacent to significant public lands and points of cultural and environmental interest. These types of attractions are fantastic amenities for local communities and can be capitalized on as a way to attract tourists, attract new and expand existing businesses, enhance property values, and provide several other economic, social, and environmental benefits for the community and region.

There are several communities within the Waccamaw region that are located immediately adjacent to many of the major waterways in our region. The City of Conway is located along the Waccamaw River and has developed the Riverwalk as an attraction to the city's downtown and as a showcase of the city's close social, economic, cultural, and environmental ties to this water resource. The City of Georgetown has immediate access to the Black River, Pee Dee River, Waccamaw River, Atlantic Intracoastal Waterway, the Sampit River, and Winyah Bay. The city is a hub of marine activity and one of the main attractions of its downtown area is the city's Harborwalk on the Sampit River. As a historic seaport, Georgetown has long and important ties to the region's watershed, which is still a focal point as the city's primary identity. The Town of Kingstree is closely linked to the Black River. Several access points and significant shoreline park areas make the Black River an important asset to the Town of Kingstree. The centerpiece of Murrells Inlet's commercial district is the Marshwalk, which provides visitors with exceptional views of the Murrells Inlet estuary while also incorporating interpretive signage that provides educational information about the marsh ecosystem and explains Murrells Inlet's cultural ties to this unique natural resource. As these communities continue to pursue new economic opportunities associated with their respective water resources, it will be important for them to incorporate sustainable development practices to balance the recreational and economic opportunities fostered by their respective waterfront areas to ensure the long-term protection of these invaluable resources.

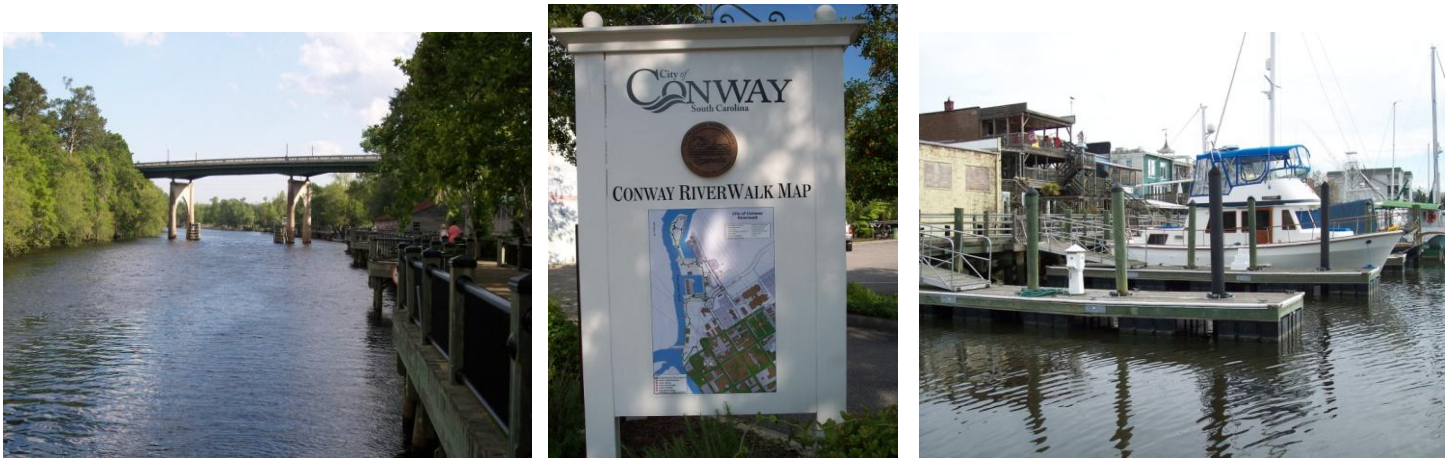


Figure 8-2 Waterfronts are actively used amenities in several communities in the Waccamaw region. To the left is the Riverwalk in Conway. To the right is dock space on the Sampit River, which is connected to the Harborwalk and several businesses along Front St. in downtown Georgetown.

The immediate coastal communities of Pawleys Island, Litchfield Beach, Garden City Beach, Surfside Beach, Myrtle Beach, and North Myrtle Beach are essentially gateway communities to the Atlantic Ocean. The economic importance of our region's beaches is quite significant. The South Carolina Department of Parks, Recreation and Tourism reported in 2002 that Horry County attracts an estimated 36,565,777 visitor days per year. Analysis of gross sales in Horry County

by the SC Department of Revenue showed that $2.78 billion of a total of $7.87 billion generated for 2004-2005 were attributed to travel and tourism expenditures of visitors to the county (Envision 2025, Horry County Comprehensive Plan). The substantial revenue generated by the tourism industry in the Waccamaw region is incentive enough to ensure the protection of our area's beaches and regional watersheds. A recent publication by the Natural Resources Defense Council, the annual "Testing the Water" report, provided an assessment of impacts related to beach pollution throughout the United States. Regrettably, the Grand Strand area received relatively poor ratings in the 2010 evaluation. Although this is an independent study and not part of any governmental regulatory water quality program, a negative image regarding the water quality at the region's beaches can have significant repercussions for the local economy.

Audubon Cooperative Sanctuary Program for Golf Courses- This education and certification program aims to assist golf course managers protect the environment and preserve the wildlife habitat areas that many golf courses provide. The Waccamaw region is noted as a premier golf destination area throughout the eastern United States. According to the SC Department of Parks, Recreation, and Tourism there are roughly one hundred golf courses within the Waccamaw region. The Myrtle Beach area alone attracts over one million golfers annually. The abundance of golf courses and associated residential communities is a significant landscape feature within the region. Water quality impacts associated with golf course developments include watershed hydrological modifications, wildlife habitat alterations, and nutrient and pesticide runoff.

To become eligible as a Certified Audubon Cooperative Sanctuary, golf courses must complete a site assessment which includes an inventory of all environmental resources and identifies potential environmental liabilities. The next step is to develop an environmental plan which addresses five environmental criteria. With the assistance of the Audubon Society, golf course managers develop management practices focused on wildlife and habitat management, chemical use reduction and safety, water conservation, water quality management, and outreach and education. Presently, there are over twenty Certified Audubon Cooperative Sanctuary golf courses in South Carolina. Within the Waccamaw region, Whispering Pines Golf Course in Myrtle Beach is the only course currently participating in this beneficial program.

More information about the Audubon Cooperative Sanctuary Program for Golf Courses can be found online at: http://acspgolf.audubonintemational.org/

Undisturbed land areas within golf course developments can be preserved through conservation easements administered through the South Carolina Conservation Bank. Since its inception in 2002, there have been issues regarding the land valuation procedures as part of the tax incentive for golf course developers to pursue conservation easements on portions of their property. This led to a reform of the South Carolina Conservation Bank Act in 2005, which now requires developers seeking a conservation easement on portions of their golf course to provide substantial evidence or donative intent as to the preservation of land within the golf course development. Since this reform, the number of applications for conservation easement status on golf course development properties has dropped significantly. Further outreach to the golf course community is needed to encourage them to participate in worthwhile conservation easement programs, such as the South Carolina Conservation Bank. The Audubon Cooperative Sanctuary program can be one strategy that enables developers to gain invaluable recognition and marketing for their conservation efforts, making it a mutually beneficial program. Additional information on the South Carolina Conservation Bank program can be found in **Chapter Two, Description of the Waccamaw Region Study Area**.

South Carolina Department of Parks, Recreation and Tourism- Recently, the South Carolina Department of Parks, Recreation and Tourism completed a tourism concept plan and strategy for several regions throughout the state. The

Tourism Product Development Concept for the Pee Dee Region- Strategy and Plan highlights the natural resources, especially the extensive network of scenic rivers, as a valuable tourism development opportunity for the Pee Dee region, including Williamsburg County. The report acknowledges the numerous water-based recreational activities such as canoeing/kayaking and sport fishing that the Pee Dee region has to offer. The plan explains that the region is linked by two key regional transportation corridors. One is the Interstate 95 corridor and the other is a corridor extending from the Charlotte metropolitan area to the South Carolina coast. One of the plan's recommendations is to improve the signage along Interstate 95 and other intersecting roadway corridors to provide information to travelers about many of the natural resource attractions located in the region and direct potential visitors to these sights. Another recommendation in the plan is to expand the facilities and amenities at each of the identified destination sites throughout the region. The Lynches River County Park is cited as a good example of a recreational area that showcases the unique ecological features of this portion of the Lynches River by incorporating a boat launch, an interpretive hiking trail, and an environmental discovery center. Visitors are able to enjoy a fun and educational experience, while enjoying the natural scenic features of the Lynches River and surrounding landscape. Other facility needs include the construction of additional boat landing sites, in particular along the designated Scenic River segments of the Lynches, Little Pee Dee, and Black Rivers.

The *Tourism Product Development Concept for the Waccamaw Grand Strand Region*, *Strategy and Plan* highlights the importance of the natural features of the state's coastal areas towards a successful and sustainable tourism economy. Specific focal points of the plan are the Grand Strand beaches and the extensive network of waterways including Winyah Bay, the Atlantic Intracoastal Waterway, and the Waccamaw River. The plan promotes the expansion of recreational activities outside of the immediate coastal areas into other natural areas along the region's scenic rivers. It is expected that many beach visitors would be drawn to nearby natural heritage and cultural heritage activities if there was further promotion and improved access to these attractions. The plan recommends the development of a brand concept such as a Waccamaw Tourism Trail that would link and highlight many of the wonderful natural features and destinations of the area including Brookgreen Gardens, Huntington Beach State Park, Myrtle Beach State Park, riverfront plantation sites, Hobcaw Barony, and the Waccamaw River National Wildlife Refuge. In the development of this type of a tourism product, the plan strongly encourages the incorporation of sustainable tourism development principles so that the environmental integrity of the Waccamaw River watershed is protected. The plan suggests that Georgetown could be used as the central destination hub for many types of water excursion programs that may be developed along the Waccamaw region.

The South Carolina Department of Parks, Recreation and Tourism state Tourism Development Plans can be accessed online at: http://www.scprt.com/tourism-business/tourism-development-plan.aspx

ECONOMIC DEVELOPMENT MANAGEMENT STRATEGIES

As mentioned in the introduction of this chapter, water resources need to be viewed and managed as an economic good. With that in mind, water quality has a tremendous impact on several areas of the regional economy. In the case of industrial activities, water is a primary input in manufacturing processes. Industrial waste byproducts, such as discharged effluent can have negative impacts on local waterbodies if it is not adequately treated or reused for other industrial operation purposes. Residential and commercial real estate development has been a major segment of the economy in the Waccamaw region over the last twenty years. Real estate values can fluctuate significantly based on local water quality, mostly due to the implications polluted water can have on the quality of life for local residents and visitors. The development community has a role to play in ensuring that new construction and redevelopment sites are properly designed to minimize water quality impacts associated with stormwater runoff. This section highlights new trends in industrial and real estate development that are focused on realizing the economic benefits of protecting the environment, in particular the region's water resources.

Industrial Water Use

Future industrial development is strongly dependent on long-term investments in the region's waterways. The Atlantic Intracoastal Waterway is a vital asset for shipping goods along the eastern seaboard. The Port of Georgetown is one of two port facilities in the state and is essential for providing raw material and shipping manufactured products to and from the industries along the Sampit River. Long-term management of both of these waterway assets requires large scale dredging and navigational channel maintenance.

Local industries rely heavily on the availability of raw water for the production of manufactured goods. **Table 8-2** provides an estimate of daily industrial water use in each of the three counties in the Waccamaw region. As the table indicates, the industrial sector of the economy in Georgetown and Williamsburg Counties constitutes a major proportion of the total water that is used in each respective county.

Figure 8-3 Industrial manufacturing comprises a significant proportion of the local economic base in the Waccamaw region. Georgetown Harbor is a location with multiple active industrial sites

Table 8-2 Industrial Water Use in the Waccamaw Region (2005)

County	Industrial Water Use (Million Gallons per Day)	Total Water Use (Million Gallons Per Day)
Horry	**0.48 MGD**	**171.42 MGD**
Georgetown	**33.97 MGD**	**68.46 MGD**
Williamsburg	**2.47 MGD**	**6.22 MGD**
Source: United States Geological Survey, 2005		

As was mentioned in the introduction of the chapter, industrial effluent discharge limitations and in-stream assimilative capacity are dependent on existing water quality conditions and the technologically-based performance standards for each industrial sector. A burgeoning economic development concept in the industrial sector is the creation of eco-industrial parks. The concept of industrial ecology was initially defined in the early 1990s by business strategist, Hardin Tibbs, in his influential paper entitled, "Industrial Ecology: an Environmental Agenda for Industry". His vision of industrial ecology consisted of six main elements summarized below:

- **Industrial ecosystems:** Fostering cooperation among various industries whereby the waste of one production process becomes the feedstock for another.
- **Balancing industrial input and output to the constraints of natural systems:** Identifying ways that industry can safely interface with nature, in terms of location, intensity, and timing, and developing indicators for real-time monitoring.
- **Dematerialization of industrial output:** Striving to decrease materials and energy intensity in industrial production.
- **Improving the efficiency of industrial processes:** Redesigning production processes and patterns for the maximum conservation of resources
- **Development of renewable energy supplies for industrial production:** Creating a world-wide energy system that functions as an integral part of industrial ecosystems
- **Adoption of new national and international economic development policies:** Integrating economic and environmental accounting in policy options.

The end objective of eco-industrial park development is to improve overall economic gains by reducing industrial production costs for each business while minimizing environmental impacts associated with industrial operations. The federal government through the US Department of Energy and the US Environmental Protection Agency oversee several assistance programs to encourage technological advancement and increased application within the industrial sector across the country.

A brief profile of several of these initiatives is provided below:

US EPA Environmental Technology Verification Program was established in 1995 as a means to test the performance of new technologies that have the potential to improve the protection of the environment and human health. Performance verification based on developed protocols can help expedite the implementation of proven and effective products. This voluntary program works as a public-private partnership between the US EPA and nonprofit testing and evaluation organizations. The US EPA Environmental Technology Verification Program has established the Water Quality Protection Center as a facility that focuses specifically on analyzing the performance of commercially ready technologies designed to protect groundwaters and surface waters from contamination.

More information about the US EPA Environmental Technology Verification Program and a list of all the products that have been tested can be found online at: http://www.epa.gov/etv/

US EPA Environmental Technologies Opportunities Portal is a database that provides resources to industries, businesses, and local governments to pursue opportunities to foster the development of new innovative and cost effective environmental technologies. Through this resource, prospective interest groups can learn about environmental technologies that are suitable for their facility operations, access grant opportunities, and explore potential public private partnership opportunities to get involved in US EPA sponsored projects and initiatives. This US EPA resource also guides and supports prospective researchers through each stage of the technology development process. This process entails the creation of a technological concept, thorough research of the proposed technology, demonstration of the technological application, final verification and reporting, commercialization of the technology, and widespread access and utilization by an end-user market.

More information about the US EPA Environmental Technologies Opportunities Portal can be found online at: http://www.epa.gov/etop/

International Organization for Standardization (ISO): 14000 series for Environmental Management The ISO is a leading organization that publishes facility management standards for businesses and municipal governments designed to ensure the quality, safety, reliability, conformity, and overall efficiency of a product or management activity. Standards are structured to share knowledge and expertise regarding technological advances and good management practices. The ISO has recently released a series of standards that can be implemented by both the private and public sector to take a proactive approach in addressing environmental management issues. The ISO 14000 standards series for environmental management consists of over 570 individual standards addressing concerns related to air quality, water quality, soil management, noise, and for controlling the transport of dangerous goods. The standards focus on specific management activities, auditing protocol, environmental performance evaluation, environmental product labeling and declarations, and life-cycle assessments.

More information on the ISO 14000 series for Environmental Management can be found online at: http://www.iso.org/iso/iso_catalogue/management_and_leadership_standards/environmental_management.htm

Further discussion on the relationship between water quality management and industrial development can be found in **Chapter Four, Wastewater Treatment**.

Low Impact Development/ Green Infrastructure

Figure 8-4 Example of a biotention swale adjacent to a residential neighborhood. *Photo courtesy of US EPA*

An emerging and important trend in water quality management has been the shift towards incorporating Low Impact Development design elements at residential and commercial development sites. The basic principle behind LID is a focus on the reduction of pollutant loadings by managing on-site stormwater runoff as close to its source as possible. One of the greatest benefits of implementing LID practices is to minimize modifications of the existing hydrological characteristics on proposed development sites. In order to accomplish these objectives, the following general LID strategies should be pursued:

- **Conserve existing resources:** At the individual lot and neighborhood scale, preserve trees and wetland features, and retain drainage patterns, on-site topography, and existing soils.
- **Minimize impact:** Construction activities can alter the natural hydrology within a watershed. By reducing the amount of clearing and grading, and the total area of impervious surfaces constructed can help to retain the natural hydrological characteristics of the development site.
- **Optimize water infiltration:** The objective of this strategy is to slow stormwater runoff rates by retaining natural drainage patterns and avoiding structures that channelize stormwater flows.
- **Create areas for local storage and treatment:** Attempt to distribute stored flows across the landscape by using rain gardens or bioswales which allow for the collection, retention, and ultimate infiltration of stormwater runoff.
- **Build capacity for maintenance:** The effectiveness of many LID practices is dependent on having a reliable long-term maintenance program in place. This often entails educating homeowners and property managers about how each LID application functions and the maintenance requirements necessary to ensure that the system continues to provide water quality management benefits.

By utilizing systems that mimic the natural on-site hydrology, LID techniques can effectively remove nutrients, pathogens, and metals from stormwater runoff. Since LID practices utilize hydrological processes such as infiltration and evapotranspiration, an additional benefit is the decreased need for large scale stormwater infrastructure investments. It is important to conduct a thorough site assessment prior to identifying the LID applications that would be most effective at reducing stormwater runoff from a particular site. Site scale LID practices include the installation of permeable pavement, green roofs, stormwater planters, vegetated swales, and constructed stormwater wetlands. Generally, it is necessary to incorporate multiple LID applications on a single development parcel. A full description of several green infrastructure/ Low Impact Development practices is provided in **Chapter Six, Non-point Source Pollution.**

An Economic Assessment of Low Impact Development Practices When evaluating the economic cost and benefits of LID practices, it is important to analyze a wide range of factors including the initial construction costs, the long-term life cycle costs, and the resulting benefits such as improved environmental functionality and services. It is also useful to explain what the direct benefits are to each group of LID stakeholders including homeowners, local governments, developers, and the greater community. Each of these groups will benefit from Low Impact Development in varying ways. Trends in real estate development have fluctuated dramatically since the global recession in the late 2000's. This economic decline affected the housing market significantly resulting in a high incidence of foreclosure and property vacancies. These current economic conditions could present opportunities to incorporate Low Impact Development as a viable and economically appealing alternative once the real estate sector begins to recover. The following section

provides an overview of a factsheet published by NC State University, which explains the types of economic benefits each of these stakeholder groups would expect from implementing LID practices.

- **Benefits to developers**:
  - Reducing the land area needed for stormwater retention ponds, in turn increases the land available for the construction of additional commercial or residential building space.
  - Reduces the construction costs spent on stormwater related infrastructure associated with curb, gutter, and storm sewers.
  - Lots in neighborhoods designed with LID elements are often sold at higher prices than lots in competing neighborhoods.
- **Benefits to homeowners**:
  - Onsite stormwater management reduces the threat of downstream flooding.
  - LID practices such as tree preservation and planting, and green roof installation, significantly reduces the energy costs of cooling a home. Reducing the amount of pavement area utilized can also enhance this economic benefit.
  - Depending on the municipality, homeowners may be credited with a reduction in stormwater utility fees by implementing LID practices.
  - The preservation of trees, open space, wildlife habitat, and other natural amenities can help raise property values in a subdivision that incorporates LID practices into the neighborhood design.
- **Benefits to the local government**:
  - Water quality management strategies such as LID implementation helps to protect water quality, in turn helping to maintain real estate values and associated property tax revenues.
  - LID practices help to reduce stormwater runoff volumes therefore minimizing concerns related to inflow and infiltration into the sanitary sewer system.
  - Reduces public expenditures needed to install and maintain stormwater infrastructure.
  - LID implementation can be one aspect of an overall water quality management strategy, which can help reduce regulatory costs associated with TMDL compliance, etc.
- **Benefits to the local community**:
  - LID practices can serve as one management strategy used to protect economically valuable water resources by reducing flooding, improving water quality, increasing groundwater recharge capabilities, and enhancing community aesthetics.
  - LID practices can help to maintain clean water in our communities, therefore reducing the costs of treating drinking water.
  - Clean water can provide a tremendous quality of life benefit for residents of a community. Again, implementing LID practices can be one aspect of a comprehensive water quality management effort on a local and regional scale.

Conservation Subdivisions

The main objective of a conservation subdivision is to allow for the development of residential and commercial properties while conserving sensitive and valuable natural resources such as critical wildlife habitats and wetland areas on a land parcel.

The benefits of this type of development strategy are numerous:

- Open space and wetlands provide significant storage and retention areas for stormwater runoff. Retaining these assets minimizes the amount of sedimentation and polluted runoff that can potentially degrade the quality of local waterways.
- If planned properly, the open space protected within a conservation subdivision can become part of a larger network of open space, which can provide further environmental benefits and be utilized as a recreational resource for the greater community.
- By clustering residential units into specific areas on a parcel of land, the road and utility infrastructure needed to serve the same number of units in a typical conventional subdivision is greatly reduced. Clustered residential site patterns also help to minimize land disturbance during the construction phase of the development, thereby reducing the potential environmental impacts of erosion and sedimentation.
- Provides an additional housing market for individuals and families that value the emphasis of open space and environmental protection that a conservation subdivision is designed to encourage.

One of the common roadblocks many communities face in encouraging the use of conservation subdivisions within their jurisdictions is the inflexibility of many zoning ordinances, particularly provisions related to density, height, and setback restrictions that are critical components to designing an effective conservation subdivision. Reviewing and updating zoning ordinances is often a necessary step in order to permit flexible design standards that enable the incorporation of clustered residential development patterns.

Transfer of Development Rights Program

A transfer of development right (TDR) program is a type of land use management strategy that establishes a market for the purchase of development rights among property owners in a municipality or a county. Land owners who choose to sell their development rights agree to relinquish their legal right to construct new residential or commercial buildings on their property. Developers who purchase the development rights of another land owner are allowed to increase the density of residential or commercial development above the outlined restrictions of the zoning district that their property is located in. In a typical TDR program, separate districts are established that identify areas targeted for land preservation and other areas that are targeted for increased density. The ultimate objective of the TDR program is to mitigate growth pressures in rural areas thereby preserving lands that hold significant cultural and/or environmental value for a community. Meanwhile, land owners in these rural supply side sending districts can still realize economic and financial gain from their property by selling their development rights. Property owners in urban demand side receiving districts also benefit by increasing the size or number of residential or commercial units that they may be permitted to be built on their land.

A community benefit is that local governments can better manage the community's overall growth by encouraging development patterns suitable for public transportation investments and vibrant urban neighborhoods. From a water quality perspective, TDR programs can be a very effective way to conserve lands, such as wetlands and forested areas, which provide numerous environmental services and help to maintain a healthy watershed ecosystem. Poorly planned growth into rural areas has in many cases caused serious unintended consequences that have degraded the natural environment.

ECONOMIC DEVELOPMENT GOALS AND RECOMMENDATIONS

The following section provides a list of goals and corresponding recommendations to enhance water quality protection as a key objective in the region's overall economic development strategies. The goals outlined in this chapter emphasize the importance of our region's local water resources as a major attraction of the Waccamaw region and therefore a

centerpiece to the local tourism economy. Other goals emphasize the historical and cultural importance of local waterways to several communities throughout the Waccamaw region. Finally, recommendations designed to promote sustainable industrial, residential, and commercial development are also provided.

Goal One: Develop dedicated funding sources to protect water resources that provide social, recreational, and economic value to the Waccamaw region. ***Recommendations include:***

- Evaluate instituting a penny sales tax dedicated to preserving open space, particularly in sensitive waterfront and wetland areas throughout the region.
- Consider utilizing a percentage of Accommodations and Hospitality Tax revenues towards watershed management practices, especially those aimed at protecting tourist related natural resources such as local beaches and shellfish harvesting areas. Also consider utilizing this type of revenue source to enhance amenities that further promote the ecotourism industry within the Waccamaw region.
- Ensure that resources are provided to deal with problems such as illegal dumping and litter. These issues can significantly degrade local water quality and can also cause economic impacts on the tourism industry, which relies heavily on maintaining aesthetically appealing public areas including the beach and local waterfronts. Programs such as Keep Georgetown Beautiful and Keep Horry County Beautiful are critical in bringing awareness to issues related to litter and are effective at maintaining an adequate level of response through community clean up volunteer events, etc.
- Establish a dedicated revenue stream to maintain the functionality of key ports and navigational channels in important waterways to the industrial economic sector such as the Port of Georgetown and the Atlantic Intracoastal Waterway.
- Evaluate all of the financial, economic, environmental, and social costs and benefits associated with each investment made towards protecting water quality within the Waccamaw region.

Goal Two: Provide incentives to private industries and businesses to institute technologies and best management practices to mitigate potential water quality problems related to their respective facility operations. ***Recommendations include:***

- Create local and regional partnerships through the US EPA Environmental Technology Opportunities Portal to investigate the utilization of new innovative technologies to protect local water resources.
- Work with local and regional economic development agencies to promote the creation of eco-industrial parks within the Waccamaw region. Consider ways to incorporate eco-industry principles into existing industrial parks located in the Waccamaw region.
- Encourage local governments and private businesses to adopt the ISO 14000 series of management standards aimed at addressing environmental management issues and concerns. Consider providing training workshops to business and industry representatives to explain the benefits of instituting these standards.
- Develop industrial pretreatment programs at each of the wastewater treatment facilities that are suitable to prospective industries seeking to relocate to the Waccamaw region. Work closely with county level and regional economic development corporations such as the Northeast Strategic Alliance to identify wastewater infrastructure needs to support industrial growth in the region. Industrial pretreatment programs are discussed in further detail in **Chapter Four, Wastewater Treatment.** More information about the Northeast Strategic Alliance can be found online at http://www.nesasc.org/

Goal Three: Institute appropriate land use practices as a means to preserve open space and protect key natural resources within the Waccamaw region. ***Recommendations include:***

- Assist local municipal and county governments with the development of comprehensive parks and open space plans that identify key land areas that can be targeted for preservation or use as passive recreational areas. Assess the potential for developing this type of plan on a regional level to address concerns across the Waccamaw region.
- Work with municipal and county governments to evaluate the potential of establishing a Transfer of Development Rights program to protect features unique to rural areas. A well coordinated TDR program can help local governments achieve a wide range of community goals including those related to environmental management while ensuring that individual property owners are able to secure a financial gain from their land investments.
- Encourage local governments to review their current zoning ordinance and land development regulations to determine if there are any barriers to the implementation of a conservation subdivision, riparian buffers, or similar strategies to incorporate open space into the fabric of existing development patterns.
- Work closely with local and national land trusts, such as the South Carolina Conservation Bank, to identify tracts of land that could be protected through the utilization of conservation easements or similar preservation arrangements.
- Identify opportunities on a state and national level such as the SC Scenic Rivers program to initiate management initiatives to support sustainable land use and economic development along sensitive waterbodies within the region.
- Focus mitigation efforts and sustainable development practices at waterbodies that are regularly impaired such as tidal swashes along the immediate coast in Horry and Georgetown Counties.

Goal Four: Assist local governments with efforts to facilitate the use of Low Impact Development practices in local communities. ***Recommendations include:***

- Encourage local governments to conduct a thorough review of existing zoning ordinances and land development regulations to determine any revisions that need to be made in order to accommodate Low Impact Development design criteria.
- Continue to host workshops through the Coastal Waccamaw Stormwater Education Consortium and the North Inlet- Winyah Bay Coastal Training program to educate local developers, elected officials, homeowners, and other targeted groups about the environmental and economic benefits of implementing LID practices.

Figure 8-5 Airlie Gardens in Wilmington, NC incoporated pervious pavement in the design of the parking lot. This cultural landmark site also utilizes grassy areas to meet overflow parking needs. Airlie Gardens, managed by New Hanover County, NC, is a great example of a public facility that incorporates stormwater best management practices for demonstration and public education purposes.

- Continue to provide recognition of successful LID projects through forums such as the Carolina Clear SC LID atlas. This resource provides information about site-specific LID applications and acknowledges project partners including engineering and architectural firms, local developers, etc. More detailed information about the LID atlas and other initiatives administered by Clemson Extension's Carolina Clear program can be found in **Chapter Six, Non-point Source Pollution**.
- Encourage local governments to install LID demonstration sites at existing and new public facility sites, where suitable.

- As outlined in **Chapter Six, Non-point Source Pollution**, work with local stakeholders to pursue the development of a Low Impact Development guidance manual with recommendations specific to coastal South Carolina communities.
- Develop incentives such as monthly stormwater utility fee discounts for businesses and residential land owners who incorporate LID practices into their site design.

Goal Five: Promote the development of ecotourism destinations and activities within the Waccamaw region. ***Recommendations include:***

- Execute recommendations pertaining to the natural resource based tourism activities highlighted in the regional tourism development plans developed by the SC Department of Parks, Recreation Tourism.
- Pursue available funding to complete ecotourism related projects such as the Waccamaw River Blue Trail and the Southeast Coast Saltwater Paddle Trail and promote their use by local residents and visitors.
- Encourage local golf courses to participate in the Audubon Cooperative Sanctuary Program for Golf Courses.
- Review state regulations pertaining to conservation easement status on golf course developments. The conservation easement program should include worthwhile incentives for developers to pursue conservation designation while maintaining the environmental integrity that is common to many land parcels that become developed as golf course communities.
- Work with regional water quality education providers to incorporate educational programming into ecotourism excursion offerings.
- Install interpretive signage explaining the importance of protecting local and regional watershed resources at heavily visited public places throughout the region.

Chapter Nine: Water Quality Monitoring

INTRODUCTION

An essential component in the overall management strategy for attaining water quality standards on a local and regional level is to maintain a comprehensive and effective water quality monitoring program. Monitoring allows water resource managers to better understand the natural conditions of the watershed and to identify the source and location of pollutants that may impact water quality. This chapter highlights the importance of water quality monitoring and aims to coordinate the efforts of all water resource entities that collect and analyze water quality data. An assessment of water quality monitoring needs is included and a strategy is outlined that provides recommendations on how local water resource management entities can collectively maximize the use of existing water quality monitoring resources and effectively develop and implement projects using the water quality data available from these limited monitoring resources.

BACKGROUND

Watershed dynamics are very complex and are influenced by natural conditions and events as well as human activities and land use patterns. An effective water quality monitoring program must account for all of the factors that influence the environmental health of the watershed. There are several indicators that water resource managers assess when evaluating the quality of surface waterbodies and groundwater aquifer systems. The types of data collected include physical, chemical, and biological measurements of the watershed system. This range of information allows water resource managers to assess the hydrodynamics of the watershed system and the water quality of each waterbody in the region. Monitoring is a key component of an adaptive management strategy to improve the decision making process to address water resource issues in our region. Monitoring provides the information necessary to pursue appropriate management strategies and to evaluate the effectiveness of infrastructure investments, regulatory programs, and other initiatives aimed at protecting the water quality in our region. Below is a brief description of several water quality indicators and their importance to watershed health that are typically examined as part of a comprehensive water quality monitoring program.

Dissolved Oxygen is critical to the survival of aquatic organisms. Dissolved oxygen levels fluctuate daily and seasonally based on the natural conditions of the watershed environment, such as water temperature and the biological activity of the vegetative community within a waterbody. Various pollutants are also known to affect the dissolved oxygen levels within a waterbody. The Lower Pee Dee River Basin is characterized as a blackwater river system, having naturally low levels of dissolved oxygen. Therefore, the local ecosystem is very sensitive to additional pollutant sources that may cause significant deviations from normal dissolved oxygen levels. It is important to have a monitoring mechanism in place that is capable of providing a long-term trend analysis of dissolved oxygen levels within the Lower Pee Dee and Santee River basin systems. This is particularly important in the Waccamaw River/ Atlantic Intracoastal Waterway system, which is currently regulated under a Biochemical Oxygen Demand Total Maximum Daily Load. A full understanding of all the factors that influence dissolved oxygen levels in the Waccamaw region can help determine which management responses are necessary in order to maintain a viable aquatic habitat within these river systems.

Biochemical Oxygen Demand (BOD) is a measurement of the amount of dissolved oxygen consumed by the decomposition of carbonaceous and nitrogenous matter in water over a five-day period. Point source discharges, such as our local wastewater utility providers and industrial sites, are subject to BOD discharge limits through the NPDES permit program. This is one means of maintaining adequate dissolved oxygen levels in our waterways.

pH is the primary measurement of the acidity/alkalinity in a waterbody. Low pH levels are common in Coastal Plain watershed ecosystems, which characterize the Waccamaw region. The chemical composition of point source and non-point sources of pollution can influence the pH levels in receiving waterbodies. Typically, aquatic organisms have a specific pH range that they can tolerate. pH measurements outside of a normal range can cause physical health impacts of native species within an aquatic ecosystem. Pollution sources with pH levels that differ substantially from the natural levels of the receiving waterbodies should be frequently monitored and proper management responses should be devised to help prevent abnormal pH excursions. Point source dischargers are generally required to maintain a pH between 6.0-8.5 in their discharged effluent.

Nutrients such as nitrogen and phosphorus are capable of accelerating the growth of aquatic plants and algae. High densities of vegetative material in a waterbody can place significant demands on the dissolved oxygen concentrations in the aquatic environment. Nutrients can easily migrate off the land surface and into waterbodies, requiring careful application of lawncare products such as fertilizers. Public education and specific stormwater infrastructure designs are critical in reducing the associated impacts of elevated nutrients in local rivers and streams. Nutrient discharge limits are often placed on point source dischargers as well.

Figure 9-1. Algal bloom caused by elevated nutrient inputs

Pathogens are microorganisms that can cause illness or disease from multiple exposure pathways such as ingestion, skin contact, or indirectly through respiratory exposure. Pathogens are very diverse microorganisms, making it difficult to assess the public health risks associated with each class of these contaminants. Epidemiological studies on pathogen exposure risks are useful to determine appropriate management strategies to minimize public exposure to harmful pathogens. The most common pathogen that is monitored is *Fecal Coliform Bacteria*, which are associated with the presence of warm-blooded animals. Fecal coliform can enter the waterway through the discharge of untreated human effluent or animal waste that may be attributed to urban runoff or livestock production. The Waccamaw region is known for its numerous water-based recreation activities. The region's tourism economy is based largely on beach activities and recreational boating in our rivers and inlets. Water quality standards have been established and public health warning systems are in place to reduce the potential transmission of disease as a result of recreational activities in contaminated waterways. It is important to maintain a water quality monitoring program that ensures the protection of public health of residents and visitors and distinguishes one source of fecal coliform from another so that a proper management and prevention program can be developed and instituted. Fecal coliform is also the primary water quality indicator used to determine if shellfish harvesting areas are contaminated. SC DHEC can close or restrict harvesting in shellfish management areas based on fecal coliform counts in the waterbody.

Enterococci Bacteria is another microbiological indicator of the presence of harmful pathogenic bacteria. The US EPA has begun to recommend using enterococci as the primary indicator of bacterial impairments for recreational water quality standards. Epidemiological studies have shown that there is a stronger correlation between the density of enterococci and the incidence of gastroenteritis than other bacteriological indicators such as fecal coliform. Gastroenteritis is the primary public health concern associated with bacterial impairments in recreational waters. SC DHEC still utilizes fecal coliform as the water quality standard measurement for the beach monitoring program and the shellfish sanitation program, however enterococci limits have been placed on several municipal wastewater treatment facilities throughout the state, including the City of Georgetown WWTF. SC DHEC is considering using *Escherichia Coli* as the primary water quality standard indicator for recreational uses in waterbodies classified as freshwater.

Another class of harmful pathogenic microorganisms are *cyanobacteria*, which are photosynthetic organisms commonly occurring in waterbodies affected by algal bloom conditions. Algal blooms thrive in eutrophic conditions, which are prone

to occur when dissolved oxygen levels decline in fresh waterbodies. Cyanobacteria can produce harmful toxins which can cause adverse neurological and gastrointestinal human health effects. It is important to minimize exposure to cyanobacteria and all other known sources of pathogenic contaminants, by not consuming untreated drinking water and minimizing recreational activities in and near known contaminated waterbodies.

Turbidity is an expression of the clarity of a waterbody and the amount of light that can pass through the surface of the water column. The presence of excessive sediment particles, plankton, and organic and inorganic matter can increase the turbidity levels in a waterbody. Elevated turbidity levels are one indication of excess erosion and other land surface runoff issues in a watershed. Rigid turbidity limits are in place for drinking water standards, therefore minimizing the amount of turbidity in a waterbody can help decrease the costs incurred during the drinking water treatment process. A common indicator that directly influences turbidity levels are *Total Suspended Solids*, which is measured as the amount of organic and inorganic particulate matter that is suspended in the water column. High levels of Total Suspended Solids within a waterbody can adversely affect fish habitats and threaten instream invertebrate populations. Total Suspended Solids limits are regulated in point source discharge permits. Sediment and other matter transported via stormwater runoff can also cause increases in Total Suspended Solid levels within a surface waterbody.

Heavy Metals are a natural constituent of the environment. However, human activities such as the burning of fossil fuels, agriculture, and industry have resulted in increased amounts of heavy metals being released into the environment. Heavy metals, such as lead, copper, nickel, mercury, cadmium, and chromium have several pathways into our waterways including, direct conveyance into a surface waterbody or through airborne deposition. Due to the complex relationship between the source and ultimate fate and transport of this type of pollution, a monitoring and coordination effort is required on a very large scale. Heavy metals, such as mercury; are of particular concern to the Waccamaw region. Several stream segments have been listed on South Carolina's 2010 303 (d) list for water quality impairments due to the presence of mercury. The greatest health risk associated with heavy metal contamination is the bioaccumulation of methylmercury in fish species. Consumption of fish with high concentrations of methylmercury can increase the chances of harmful side effects for humans, including serious neurological and cardiovascular problems. SC DHEC has drafted a mercury reduction strategy for the State of South Carolina. This plan advocates for further investigation into this water quality issue and supports regional and state efforts that aim to address this challenging problem in South Carolina.

More information about SC DHEC's Mercury Reduction Initiative can be found online at:
http://www.scdhec.gov/environment/admin/Mercury/htm/index.htm

Contaminants of Emerging Concern are a broadly defined group of chemical compounds that have been found in low concentrations in our waterways. Many of these compounds are derived from pharmaceuticals and personal care products which can enter the natural environment from the wastewater stream. The long-term impacts to the natural environment and human health risks posed by these contaminants are not yet completely understood. Further research will be necessary to fully evaluate the potential threats of these compounds and to determine the technological advancements and management practices that will be necessary to reduce all risk exposures associated with these contaminants. Monitoring will play an important role in evaluating the effectiveness of all proposed strategies to mitigate any known concerns. Monitoring will also enable researchers and water resource managers to determine if there are differences in terms of assimilative capacity in Coastal Plain watershed systems such as the Lower Yadkin Pee Dee River Basin and the Santee River Basin. One of the more advanced monitoring efforts in place has been developed by the USGS, which has established a predictive model on the concentration of Atrazine in our watersheds. This model to evaluate the transport fate of this contaminant is based on the use and management of pesticides on agricultural lands in the United States. Monitoring for many contaminants of emerging concern is inherently difficult due to the very low concentrations they are found in the environment. Predictive models such as the USGS Atrazine model could be useful

since it may be unfeasible to monitor all watershed areas at a statistically significant frequency, particularly for contaminants originating from non-point sources.

Below is a description of several biological assessment techniques common to many comprehensive water quality monitoring programs.

Figure 9-2 Biologists collecting macroinvertebrate sample

Macroinvertebrate Community Analysis is a common methodology used to assess the overall health of an aquatic ecosystem. Macroinvertebrates are an extremely diverse class of animal species that inhabit a wide range of environments. Each species has certain tolerances for various types and levels of pollutants that may be present in a waterbody. The macroinvertebrate species composition within a waterbody provides a good indication of the health of that particular location. Regular and thorough monitoring of the macroinvetebrate community over time can be very useful to watershed managers in assessing water quality trends in an area. This plan supports the development of a macroinvertebrate index for the Lower Pee Dee River Basin.

Figure 9-3 Fish tissue sampling

Fish Tissue Analysis is a method used to examine the presence of pollutants that exist at very low concentrations within the water column, oftentimes below typical analytical methods used for water quality sampling. These pollutants tend to concentrate in fish tissue at a level that can be more easily detected and measured. This type of monitoring effort is important in assessing public health risks associated with consuming certain types of fish within a watershed region. There are many stream segments within the Waccamaw region that are impaired due to elevated concentrations of mercury found in fish tissue. SC DHEC's Bureau of Water collects over 1800 fish samples each year to determine the concentrations of mercury that are present in fish species throughout the waters of South Carolina. This fish tissue monitoring effort should be continued as management agencies throughout the state determine the best approach for mitigating harmful pollutants such as mercury and other metals and organic chemicals. Information collected from this monitoring effort should be widely disseminated amongst all water resource managers and the general public.

Sediment Analysis is a monitoring technique that enables water resource managers to understand the background characteristics of the streambed sediment composition. Regular sediment monitoring can help identify pollutants that may become suspended in the sediment load and then be transported to downstream segments of the river system. Sediments have the propensity to absorb contaminants such as toxic organic compounds, metals, and nutrients. Sediment contamination is a direct threat to aquatic life as streambed sediments are a core component of many aquatic species habitats. Small benthic aquatic organisms could potentially transfer toxic concentrations of streambed sediment contaminants through the food web to aquatic species at a higher trophic level. The most comprehensive sediment monitoring dataset in coastal South Carolina is maintained by the South Carolina Estuarine and Coastal Assessment Program. A complete summary of their monitoring findings can be accessed at: http://www.dnr.sc.gov/marine/scecap/FindingsSQ_0102.htm

Table 9-1 provides a list of core water quality indicators and their applicable water quality standard category.

Table 9-1 Water Quality Core Indicators				
Aquatic Life Use Support		**Recreational Use Support**	**Fish Consumption**	**Shellfish Consumption**
Dissolved Oxygen	**Additional indicators for selected wadeable stream sites:**	*Fecal Coliform Bacteria*	*Mercury in Fish Tissue*	*Fecal Coliform Bacteria*
pH	*Macroinvertebrate community analysis*	*Enterococcus Bacteria*		
Turbidity	*Habitat assessment*			
Ammonia Nitrogen				
Cadmium	**Additional indicators for lakes:**			
Chromium	*Chlorophyll-a*			
Copper	*Total Nitrogen (Nitrate/Nitrite Nitrogen + Kjeldahl Nitrogen)*			
Lead	*Total Phosphorus*			
Mercury				
Nickel				
Zinc				

Source: *2011 State of South Carolina Monitoring Strategy- SC DHEC, Bureau of Water.*

Table 9-2 provides a list of supplemental water quality indicators:

Table 9-2 Supplemental Indicators for Aquatic Life Use Support		
Water Temperature	*Alkalinity*	**Additional indicators at freshwater sites where metals are collected**
Air Temperature	*Total Organic Carbon*	*Hardness*
Total Suspended Solids	*Iron*	**Additional indicators for lakes**
Five-Day Biochemical Oxygen Demand	*Manganese*	*Transparency (Secchi depth)*
		Additional indicators at saltwater sites
		Tide Stage
		Specific Conductance
		Salinity

Source: *2011 State of South Carolina Monitoring Strategy- SC DHEC, Bureau of Water.*

EXISTING MONITORING RESOURCES

Currently there are a number of entities that collect useful water resources data on a local, state, regional, and national scale. Some of the monitoring activities are conducted as part of state regulatory programs such as the NPDES permitting program, beach monitoring program, and the shellfish sanitation program. Other monitoring efforts such as the USGS monitoring station program provide valuable real-time data that can be used to follow long-term baseline hydrologic and water quality trends within the watershed system. Other data sources are maintained by local research institutions including Coastal Carolina University, Clemson University, University of South Carolina, and the North Inlet-Winyah Bay National Estuarine Research Reserve. In addition, Coastal Carolina University oversees an active volunteer monitoring program through the Waccamaw Watershed Academy. Collectively, these monitoring resources provide

analytical insight on a wide spectrum of water quality considerations in the Waccamaw region. A profile of many of these monitoring programs and efforts is provided below:

SC DHEC Ambient Surface Water Monitoring Program

SC DHEC oversees a statewide ambient surface water monitoring program as the primary means of evaluating water quality throughout the State of South Carolina. Historically, water quality data is collected from a statewide network of primary and secondary ambient monitoring stations and flexible, rotating watershed monitoring stations. The ambient surface water monitoring network is established to determine long-term water quality trends, assess attainment of water quality standards, identify locations in need of additional monitoring or further management response, and to provide background data for evaluating stream classifications and standards. Ambient monitoring data are also used in the process of formulating permit limits for point source discharges with the objective of maintaining state and federal water quality standards and criteria in receiving streams in accordance with the goals of the Clean Water Act. A list of all the SC DHEC ambient monitoring sites located in the Waccamaw region is provided in **Appendix C**.

Due to ongoing budget cuts, SC DHEC has scaled back many aspects of the state's ambient surface water monitoring program. As of 2011, the agency will decrease the frequency of sampling from monthly to bimonthly at fixed location monitoring sites. Also, the cyclic rotating watershed monitoring stations will no longer be sampled. Meanwhile, the probability-based monitoring component will continue to be sampled monthly. SC DHEC has established temporary special request sites to help evaluate the progress of remediation projects, assist in the development of TMDLs, and for setting NPDES permit limits.

Additional information can be found online at: http://www.scdhec.gov/environment/water/surface.htm#ambient

Monitoring Requirements under the South Carolina NPDES General Permit for Stormwater Discharges from Regulated Small MS4s

Under the existing NPDES General Permit, MS4 communities may use monitoring techniques to ensure that they are in compliance with the permit program, they have appropriately identified best management practices, evaluate progress made towards achieving program goals. Representative sampling must be taken for all monitored activities and set of test procedures must be followed. Monitoring results must be included on a Discharge Monitoring Report. Additional monitoring and reporting requirements apply to MS4s that must comply with a TMDL. Please not that these requirements could be revised pending the final adoption of the reissued NPDES General Permit for Stormwater Discharges to Regulated Small MS4s.

Please note that the monitoring provisions discussed above are referenced from the draft NPDES General Permit for Stormwater Discharges to Regulated Small MS4s.

Discharge Monitoring Requirements under the NPDES Permit Program for Point Source Dischargers

Point source discharge management agencies covered by a NPDES wastewater discharge permit must regularly monitor the effluent that is discharged from their facilities. Monitoring includes lab testing of the parameters set forth in the permit limits. The monitoring results must be published in a discharge monitoring report, which is typically submitted to SC DHEC on a monthly basis. The US EPA maintains a Permit Compliance System which contains the records of all discharge monitoring reports for all NPDES permitted facilities in the United States. The US EPA Permit Compliance System can be accessed online at: http://www.epa.gov/enviro/facts/pcs/search.html

SC DHEC Aquatic Toxicology Program

As part of the state's wastewater treatment permit program, SC DHEC conducts tests to examine the aquatic species toxicity potential of effluent discharged from municipal wastewater treatment facilities. NPDES point source discharge permit holders are required to perform these Whole Effluent Toxicity tests as part of the self-monitoring requirements of

their discharge permit. SC DHEC supplements these testing efforts as part of a US EPA grant program authorized by Section 106 of the federal Clean Water Act. SC DHEC also periodically uses this funding to perform toxicity tests on surface waters which receive effluent discharges. Typical Whole Effluent Toxicity tests involve the use of an indicator species such as the fathead minnow (*Pimephales promelas*) and utilize water with 0% effluent concentration as a control group, and water with varying levels of effluent concentration as the test group. Both acute and chronic toxicity analysis is conducted and is typically focused on key biological functions such as survival rates, reproduction, and growth. Parameters such as pH and Dissolved Oxygen are measured throughout the testing period. These tests provide essential data in determining appropriate wastewater treatment permit limits for point source discharges in order to prevent habitat loss and environmental damage as a result of effluent discharge.

SC DHEC Shellfish Monitoring Program

SC DHEC oversees a monitoring program that evaluates the water quality in shellfish harvesting areas across the state. Bacteriological monitoring and corresponding laboratory analysis is conducted at 465 sampling sites in the state's coastal areas on a monthly basis. SC DHEC also issues an annual evaluation of growing areas, which meets the US Food and Drug Administration National Shellfish Sanitation Program requirements. The purpose of this program is to ensure sanitary control of shellfish produced and sold for human consumption. The species of concern in South Carolina is the Eastern Oyster (*Crassotrea virginica),* Northern Clam (*Mercenaria mercenaria),* and Southern Clam (*Mercenaria campechiensis).*

Within each designated Shellfish Management Area, a classification system is utilized to regulate harvesting activities based on water quality conditions within each management area. A description of each classification is provided below.

- **Approved Area-** Growing areas shall be classified as *Approved* when the sanitary survey concludes that fecal material, pathogenic microorganisms, and poisonous or deleterious substances are not present in concentrations that would render shellfish unsafe for human consumption. *Approved* classifications shall be determined upon a sanitary survey that includes water samples collected from stations in the designated area adjacent to actual or potential sources of pollution. The geometric mean fecal coliform MPN shall not exceed 14 per one hundred milliliters, nor shall the estimated ninetieth percentile exceed an MPN of 43 per one hundred milliliters (per five tube decimal dilution).

Figure 9-4 Shellfish Harvesting Area

- **Conditionally Approved Area-** Growing areas may be classified as *Conditionally Approved* when they are subject to temporary conditions of actual or potential pollution. When such events are predictable, as in non-point source pollution from rainfall runoff or discharge of a major river, a management plan describing conditions under which harvesting will be allowed shall be adopted by SC DHEC prior to classifying an area as *Conditionally Approved*. Where appropriate, the management plan for each *Conditionally Approved* area shall include performance standards for sources of controllable pollution (e.g., wastewater treatment and collection systems), evaluation of each source of pollution, and a means of rapidly closing and subsequently reopening areas to shellfish harvesting. Memorandums of agreements shall be a part of these management plans where appropriate. Shellfish shall not be directly marketed from a C*onditionally Approved* area until conditions for an *Approved* classification have been met for a period of time likely to ensure the shellfish are safe for consumption. Shellstock from *Conditionally Approved* areas that have been subjected to temporary conditions of actual or potential pollution may be relayed to *Approved* areas for purification or depurated through controlled purification operations only by special permit issued by SC DHEC.

- **Restricted Area-** Growing areas shall be classified as *Restricted* when sanitary survey data show a moderate degree of pollution or the presence of deleterious or poisonous substances to a degree that may cause the water quality to fluctuate unpredictably or at such a frequency that a conditionally approved classification is not feasible. Shellfish may be harvested from areas classified as restricted only for the purposes of relaying or depuration and only by a special permit issued by SC DHEC and under department supervision. The suitability of *Restricted* areas for the harvesting of shellstock for relay or depuration purposes may be determined through the use of comparison studies of background tissue samples with post-process tissue samples, as well as other process verification techniques deemed appropriate by SC DHEC. The fecal coliform geometric mean MPN shall not exceed 88 per one hundred milliliters nor shall the estimated ninetieth percentile exceed an MPN of 260 (five tube decimal dilution).
- **Prohibited Area-** Growing areas shall be classified *Prohibited* if there is no current sanitary survey report or if the sanitary survey report or monitoring data show unsafe levels of fecal material, pathogenic microorganisms, or poisonous or deleterious substances in the growing area or otherwise indicate that such substances could potentially reach quantities that would render shellfish unfit or unsafe for human consumption.

Appendix I provides information pertaining to the current classifications at monitoring locations in Shellfish Management Areas in Horry and Georgetown County. Additional information regarding SC DHEC's Shellfish Sanitation Program can be found at: http://www.scdhec.gov/environment/water/shellfish.htm

Beach Monitoring Program

SC DHEC administers a beach monitoring program to collect routine data on bacteria levels at the state's beaches. There are 54 sampling sites within Horry and Georgetown Counties. A list of sampling sites and their respective locations can be found in **Appendix J**. Water samples are routinely collected at each sampling site between May 15th and October 15th. The specific sampling protocol is based on a Tiered Monitoring Plan. Each beach is categorized as a Tier 1, Tier 2, or Tier 3 beach, depending on the level of public accessibility and intensity of use for each particular beach. Tier 1 sites are designated as having the highest priority for monitoring resource needs.

Table 9-3 indicates the designation of each beach within the Waccamaw region study area based on the state's Tiered Monitoring Plan.

Table 9-3 Tiered Beach Rankings: Horry and Georgetown Counties

Beach Location	Length of Beach	Tier Ranking	Number of Sample Sites
North Myrtle Beach	8.6 miles	Tier 1	10
White Point Swash	N/A	Tier 1	1
Briarcliffe Acres	0.54 miles	Tier 1	2
Arcadia Beach	3.6 miles	Tier 1	4
Myrtle Beach	9.7 miles	Tier 1	12
Springmaid Beach	0.33 miles	Tier 1	1
SC State Park and Campgrounds	3.4 miles	Tier 1	4
Surfside Beach	2.1 miles	Tier 1	7
Garden City Beach (Horry County)	1.8 miles	Tier 1	2
Garden City Beach (Georgetown County)	3.4 miles	Tier 2	1
Huntington Beach State Park	3.2 miles	Tier 2	2
Litchfield Beach	3.9 miles	Tier 2	3
Pawleys Island	3.8 miles	Tier 2	3
Debordieu Beach	3.7 miles	Tier 2	2

Source: SC DHEC, Bureau of Water. Ocean Water Quality Monitoring and Notification Program

The South Carolina Tiered Monitoring Plan calls for weekly baseline sampling for Tier 1 beaches and bi-weekly baseline sampling for Tier 2 beaches. For Tier 1 beaches, supplemental monitoring is conducted after rainfall events. For both Tier 1 and Tier 2 beaches, additional samples are taken after a water quality standard is exceeded, a sewage spill or other significant pollution event has occurred, and following a public health advisory or beach closure.

If bacteria levels exceed water quality standards at a particular sampling location, public health advisories are issued. The protocol for issuing a Water Quality Exceedance Advisory is if a routine sample at a Tier 1 or 2 beach exceeds 104CFU/ 100ml, then an additional sample must be collected within 24 hours. If the 2nd sample still exceeds the 104 CFU/ 100ml threshold, an advisory takes effect. If a single routine sample exceeds 500 CFU/100ml then an immediate Water Quality Exceedance Advisory is issued. Preemptive advisories are posted in areas that typically experience elevated bacteria levels following rainfall events. These advisories are based on models developed from historical sampling trends at a particular location. Notification of an advisory must be posted at conspicuous areas on the affected beach. The advisory is also posted on SC DHEC's website at www.scdhec.gov/administration/news SC DHEC has also issued permanent warnings at specific swashes and storm water outfalls due to ongoing water quality problems at these identified areas. The most common health risk associated with swimming in contaminated ocean water is acute gastroenteritis and diarrhea.

A substantial portion of funding for the state comprehensive beach monitoring and notification program has come from a grant awarded through the federal Beaches Environmental Assessment and Coastal Health Act. The initial grant period was scheduled from fiscal year 2002 through 2009. The beaches in Horry and Georgetown Counties are tremendously valuable community amenities that are vital to the economic prosperity of the Waccamaw region. It is of the upmost importance for the State of South Carolina and all local governments to seek and maintain funding to support this important water quality monitoring program. Health risks due to ocean water bacterial contamination need to be minimized and a long-term comprehensive beach water quality sampling program is an essential tool in the region's overall beach management efforts.

Additional information regarding the State of South Carolina beach monitoring program can be found at: http://www.scdhec.gov/environment/water/ow.htm

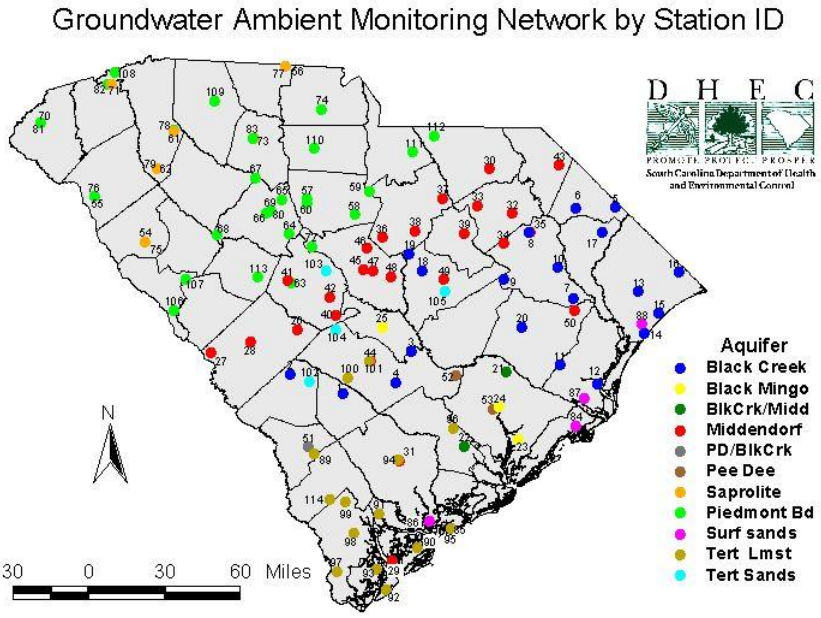
Fish Consumption Advisory Program

Since 1976, SC DHEC has been sampling various fish species throughout the state to investigate the incidence of contamination that may pose health risks to the general public. The main contaminants of concern in the State of South Carolina are mercury and polychlorinated biphenyls (PCBs). Statewide fish consumption advisories are updated on an annual basis. The advisory identifies the waterbody where contamination is likely occurring, the species of fish to take precautions with prior to consumption, and the recommended frequency of consumption to adhere to for each species in that particular waterbody. Additional consumption advisories are provided for at-risk groups such as young children and women who are pregnant, nursing, or who expect to become pregnant. Some of the fish species of concern in the Waccamaw region include King Mackerel, Swordfish, Shark, Tilefish, Redear Sunfish, Largemouth Bass, Bowfin, Black Crappie, Blue Catfish, Chain Pickerel, Redbreast Sunfish, and Channel Catfish.

More information about the South Carolina Fish Consumption Advisory Program and an updated list of fish consumption advisories throughout the state can be accessed via: http://www.scdhec.gov/environment/water/fish/index.htm

Ambient Groundwater Monitoring Program

The State of South Carolina has a comprehensive network of 116 well sites that monitor the groundwater quality in all ten of the aquifers that traverse the state. This network consists of both public and private water supply wells that enable the state to determine natural differences in geochemistry between each aquifer throughout the state. In addition, this background water quality data can be utilized as an indicator of variations due to potential contamination. Below is a figure that indicates the geographic distribution of monitor well sites in South Carolina:



SC DHEC issues a 5 year Ambient Groundwater Quality Monitoring Report for each of the watershed basins in the state. **Table 9-4** provides a list of well sites that are included in the most recent study released for the Pee Dee Basin in 2003.

Table 9-4 Groundwater Monitoring Well Sites in the Pee Dee Basin

Well ID	Location	County	Aquifer	pH	Conductance
AMB-006	Town of Latta- Well#1	Dillon	Black Creek	6.8	155
AMB-007	Town of Johnsonville	Florence	Black Creek	9.2	392
AMB-009	Town of Olanta	Florence	Black Creek	7.2	127
AMB-010	Town of Pamplico	Florence	Black Creek	8.6	155
AMB-012	Georgetown #2	Georgetown	Black Creek	8.7	1030
AMB-020	Town of Kingstree	Williamsburg	Black Creek	8.0	569
AMB-030	Town of Patrick #1	Chesterfield	Middendorf	5.5	12.8
AMB-032	City of Darlington- Main	Darlington	Middendorf	5.1	29.9
AMB-033	City of Hartsville	Darlington	Middendorf	7.0	43.4
AMB-034	Town of Timmonsville	Florence	Middendorf	6.8	40.7
AMB-037	Town of Bethune	Kershaw	Middendorf	5.2	31.2
AMB-039	City of Bishopsville	Lee	Middendorf	5.4	15.1
AMB-043	Town of Cilo	Marlboro	Middendorf	5.9	48.7
AMB-049	Sumter Plant #1	Sumter	Middendorf	5.6	42.6
AMB-050	Town of Hemingway	Williamsburg	Middendorf	8.6	682
AMB-111	White Bluff Baptist Church	Lancaster	Piedmont Bedrock	6.4	66.7
AMB-112	Westside Estates	Chesterfield	Piedmont Bedrock	7.4	128

Source: *SC DHEC, South Carolina Ambient Groundwater Quality Report, 2003 Summary: Pee Dee Basin*

Additional information regarding the Ambient Groundwater Monitoring Program can be found at:
http://www.scdhec.gov/environment/water/ambient.htm

United States Geological Survey Water Quality Monitoring Station Network

The United States Geological Survey (USGS) is a major hub of scientific data pertaining to the water resources of the United States. The USGS administers the National Water Information System, which collects real-time water flow data (e.g. gage height and river discharge) and water quality data (e.g. pH, specific conductance, DO, temperature) at fixed monitoring stations throughout the country. Data collected at each monitoring site is linked to an information database which is available online at http://waterdata.usgs.gov/nwis/rt Most monitoring stations are capable of recording data at 15 minute intervals.

Figure 9-5 USGS Station at Atlantic Intracoastal Waterway at Hwy 9 near Nixons Crossroads, SC

The sophisticated data collection capabilities that are provided by the USGS monitoring station network is of tremendous value to the State of South Carolina and to the water resource managers of the Waccamaw region. Previously, data collected from the USGS monitoring station network was utilized for the calibration of the hydrodynamic flow and water quality models for the Pee Dee/Waccamaw/ Atlantic Intracoastal Waterway system. One model was used to determine the waste assimilative capacity of waterbodies with tidally influenced streamflows. SC DHEC developed and continues to administer the Total Maximum Daily Load allocations that were calibrated by the USGS using the BRANCH and BLTM models based off of data collected by the USGS monitoring network.

Table 9-5 provides information pertaining to the USGS monitoring stations located within the Waccamaw Region.

Table 9-5 USGS Monitoring Stations Located in the Waccamaw Region

Station ID	Station Location	Measureements	Funding Sources
02136000	Black River at Kingstree, SC	Discharge, Gage Height, Precipitation	
02171645	Rediversion Canal at Santee River near St. Stephen, SC	Gage Height, Stream Velocity, Discharge, Temperature, DO, Conductance, pH	US Army Corps of Engineers
02172700	Santee River near Jamestown, SC	Stream Velocity, Gage Height, Discharge	US Army Corps of Engineers
02171850	South Santee River near McClellanville, SC	Gage Height	US Army Corps of Engineers
02171905	South Santee River @ State Pier	Gage Height	US Army Corps of Engineers
02136361	Turkey Creek near Maryville, SC	Gage Height, Discharge	Santee Cooper
02110815	Waccamaw River near Hagley Landing, near Pawleys Island, SC	Gage Height, Dissolved Oxygen, Temperature, Conductance	Waccamaw Regional COG
021108125	Waccamaw River near Pawleys Island	Gage Height, Conductance, Temperature	Georgetown County WSD
02135200	Pee Dee River at Hwy 701 near Bucksport	Stream Velocity, Discharge, Gage Height	USGS
02110802	Waccamaw River at Bucksport, SC	Gage Height, DO, Temperature	Horry County Stormwater
02110729	Tributary to Intracoastal Waterway at Hwy 707 in Socastee	Gage Height, Stream Velocity, Precipitation	
02110704	Waccamaw River at Conway Marina in Conway, SC	Conductance, Gage Height, Discharge, Stream Velocity, DO, Temperature, Turbidity, pH, Discharge (tide filtered)	Horry County Stormwater, Santee Cooper, City of Conway.
02110777	Intracoastal Waterway at Highway 9 at Nixon Crossroads, SC	Conductance, DO, Temperature, Gage Height	Waccamaw Regional COG
02110400	Buck Creek near Longs, SC	Temperature, Conductance, DO, pH, Turbidity, Gage Height, Stream Velocity, Discharge, Precipitation	Horry County Stormwater
02110500	Waccamaw River near Longs, SC	Discharge, Gage Height, Temperature, DO, pH, Turbidity, Conductance	Horry County Stormwater
02135000	Little Pee Dee River at Galivants Ferry, SC	Discharge, Precipitation, Gage height	Horry County Stormwater
02135060	Chinners Swamp near Aynor, SC	Temperature, Conductance, DO, pH, Turbidity, Gage Height, Stream Velocity, Precipitation	Horry County Stormwater

Source: *United States Geological Survey, National Water Information System*

Funding for the operation and maintenance of each of these monitoring stations is shared by the USGS and its partnering entities through the Federal Cooperative Water Program. The Waccamaw Regional Council of Governments formed a collaborative with its water resource partners to share the costs of managing this system. Unfortunately, the costs of funding this network have risen steadily over the course of time, requiring additional contributions from each of the Section 208 program partners. In 2009, the Waccamaw Regional COG Section 208 program decided to scale back the number of stations that could be supported through the collaborative established with the USGS.

The following stations were discontinued from the Section 208 program monitor station cost-sharing program:

- **02110704** Waccamaw River at Conway Marina (currently being funded by Horry County Stormwater, Santee Cooper, and the City of Conway)
- **02110760** AIW at Myrtlewood at Myrtle Beach
- **02110725** AIW at Hwy 544 at Socastee
- **02110802** Waccamaw River at Bucksport (currently being funded by Horry County Stormwater)
- **02135200** Pee Dee River at Hwy 701
- **02136358** Sampit River near Georgetown

A problem cited following the decision to discontinue the above mentioned monitoring stations, was a lack of management response to the data that was collected by the monitoring network. In addition, there was an acknowledgement that all of the various users of the data provided by the USGS National Water Information System were not accounted for in the partnership network established through the Waccamaw Region Section 208 Program. In other words, some of the management entities involved in the Federal Cooperative Water Program were paying above and beyond their share of the costs of funding the monitoring network.

The USGS National Water Information System is an invaluable core component of the overall water quality monitoring efforts in the Waccamaw region. This network has one of the longest continuous data sets in our region and provides exceptional visualization and trend analysis tools. From a long-term perspective, there needs to be a clear understanding among the Section 208 program partners regarding the organization of this monitoring program and how the data will be utilized in our water quality management efforts. Moving forward it will be useful to identify all of the users of this monitoring resource and develop a management strategy that equitably distributes the cost of funding the stations within this monitoring network.

North Inlet- Winyah Bay National Estuarine Research Reserve System Wide Monitoring Program

Figure 9-6 Field Lab at North Inlet- Winyah Bay NERR

The North Inlet-Winyah Bay NERR has been a lead entity in providing scientific data and analysis pertaining to estuarine and coastal ecosystems in the State of South Carolina and the southeast United States. Research conducted at the North Inlet- Winyah Bay NERR site has contributed significantly to our understanding of the short-term variability and long-term changes of the water quality and biotic diversity of our estuarine ecosystems. It provides the baseline data necessary to evaluate changes in estuarine ecosystems in response to natural conditions and environmental stressors caused by human impacts. This information has been vital in assisting policy makers and water resource managers to develop and implement an effective comprehensive coastal zone management program in the State of South Carolina. These long-term monitoring and research efforts are part of the National Estuarine Research Reserve's System-Wide Monitoring Program. The North Inlet Winyah Bay NERR has been a key partner in the South Carolina Estuarine and Coastal Assessment Program. This collaborative was initiated by SC DNR and SC DHEC as an ongoing

effort to monitor the condition of the estuarine habitats and associated biological resources throughout the state. This diverse partnership consists of a wide range of experts and program resources to conduct an in-depth monitoring and research program targeting issues related to estuarine water and sediment quality. The program investigates sensitive estuarine areas such as tidal creeks which are important nursery habitats for several aquatic species and commercially important shellfish species. These tidal creek areas often interface closely with developed upland areas and therefore can be a direct entry point for pollutants transported by stormwater runoff.

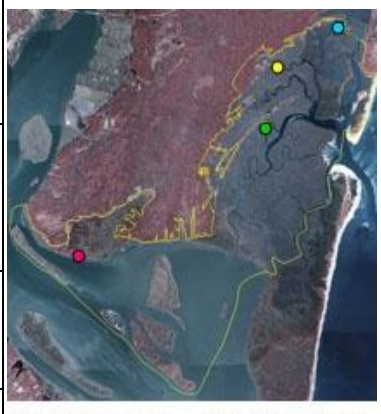
The following section provides a summary of the types of data collected as part of the System-Wide Monitoring Program and includes a description of the monitoring sites within the North Inlet- Winyah Bay NERR.

- **Meteorological Monitoring**: The long-term collection of meteorological data enables the Reserve to analyze climatic change trends over time. The Reserve maintains a weather station which collects data such as wind speed and direction, air temperature, barometric pressure, relative humidity, rainfall and solar radiation. This data is collected continuously, providing nearly real-time data accessibility.
- **Water Quality Monitoring:** The Reserve maintains four permanent monitoring sites which measure the variability and long-term water quality trends within the reserve's boundaries. Data is collected to measure trends in several parameters including specific conductivity, salinity, dissolved oxygen, water temperature, pH, turbidity, and water level. These parameters are useful indicators to assess the quality of the habitat for local estuarine species. Each monitoring station is equipped to collect measurements continuously in 15 minute intervals, providing nearly real-time data accessibility.
- **Water Chemistry and Chlorophyll Monitoring:** The four reserve monitoring sites are also utilized to collect water chemistry and chlorophyll data. Specific water chemistry parameters that are measured include dissolved inorganic nutrients, total nitrogen, total phosphorus, total suspended solids, and dissolved organic carbon. Measurements are collected at the four monitoring sites in 20 day intervals. These data sets allow researchers to assess impacts of nutrient enrichment and eutrophication in estuarine waters.

Table 9-6 provides a brief description of each permanent water quality monitoring station maintained at the North Inlet-Winyah Bay NERR.

Table 9-6 North Inlet- Winyah Bay NERR Monitoring Stations

Station Name	Site Description
Oyster Landing	This site is located at the upper reaches of two tidal creeks near the western upland edge of the North Inlet basin. This site is representative of relatively pristine conditions due to the absence of any development or disturbed land in its drainage area. The average depth at this site is 2.0 meters and the tidal range is 1.4 meters. Water quality, nutrient, and chlorophyll monitoring data are collected at this site. This monitoring station was established in 1993.
Debidue Creek	This site is located at the northern end of the research reserve and is adjacent to the DeBordieu Colony residential development. The average water depth at this monitoring site is 2.2 meters and the tidal range is 2.0 meters. This site is representative of an impacted estuarine waterbody due to its close proximity to developed land upstream. Water quality, nutrient, and chlorophyll monitoring data are collected at this site. This monitoring station was established in 1998.
Clambank Creek	This monitoring site is centrally located within the research reserve. It is located near the main channel of North Inlet and is influenced by oceanic waters entering the creek. Water quality, nutrient, and chlorophyll monitoring data are collected at this site. This monitoring station was established in 1998.
Thousand Acre	This site is located along the northern side of Winyah Bay. The average water depth at this station is 2.0 meters and the average tidal range is 1.0 meter. The land adjacent to the station consists of former rice fields and undeveloped pine forest and forested wetlands. Upstream of the monitoring site is the City of Georgetown which contributes significant discharges from heavy industries such as a steel mill, paper mill, chemical plants, and a wastewater treatment plant. Water quality, nutrient, and chlorophyll monitoring data are collected at this site. This monitoring station was established in 1993.



The North Inlet-Winyah Bay NERR site has also been a participant in the National Atmospheric Deposition Program since 2002. This research effort was established in 1977 to measure atmospheric deposition and study its effects on the environment. Weekly samples of precipitation are collected at the pier located at Oyster Landing. These water samples are analyzed for the following parameters and constituents: pH, sulfate, nitrate, ammonium, chloride, and base cations including calcium, magnesium, potassium and sodium.

Additional information about the monitoring program established at the North Inlet-Winyah Bay NERR can be found at: http://www.northinlet.sc.edu/research/swmp.html

Coastal Carolina University Waccamaw Watershed Academy

In 2004, Coastal Carolina University established the Waccamaw Watershed Academy to serve as a community resource to help local governments address water quality management issues along the South Carolina coast. The program is supported by a state-certified Environmental Quality Laboratory, which enables university researchers to conduct field research projects and conduct ongoing water quality monitoring at stream locations throughout the region. The Waccamaw Watershed Academy directly assists Horry County, Georgetown County, and the City of Conway to fulfill their monitoring requirements under the NPDES Phase II Stormwater Discharge permit. Seven sites are monitored at USGS gauging stations and at SC DHEC monitoring locations within the Waccamaw River and Pee Dee River watersheds. Monitoring locations include Buck Creek, Highway 9, Crabtree Swamp, Conway Marina, Bucksport, Hagley Landing, and Chinners Swamp. Samples are collected bi-weekly and record temperature, conductivity, dissolved oxygen, and pH conditions in-situ. Samples are also tested in the Environmental Quality Laboratory for Total Phosphorus, Total Nitrogen, Fecal Coliform Bacteria, Chlorophyll, Turbidity, 5-Day Biochemical Oxygen Demand, and Water Toxicity. The primary objectives of this program are to evaluate site specific normal water quality conditions in the Waccamaw River and Pee Dee River, assess long-term water quality trends, and detect the occurrence of illicit stormwater discharges.

Another valuable program overseen by the Waccamaw Watershed Academy is the Waccamaw River Volunteer Monitoring Project. Since 2006, volunteers have been trained and furnished with field equipment to monitor twelve sites along various sections of the Waccamaw River in Georgetown and Horry Counties. Water quality samples and monitoring data are collected on a routine basis at each site, twice per month. The following water quality parameters are analyzed during each monitoring session: Conductivity, Dissolved Oxygen, E. Coli, Nitrate, pH, Phosphorus, Total Dissolved Solids, Temperature, and Turbidity. This data provides a comprehensive assessment of water quality conditions in the Waccamaw River.

Figure 9-7 Volunteers recording water quality data on the Waccamaw River

Table 9-7 below provides a list of sites along the Waccamaw River that are monitored by the Waccamaw River Volunteer Monitoring Project.

Table 9-7 Sites Monitored by the Waccamaw River Volunteer Monitoring Project	
Highway 9	*Peachtree Landing*
Reaves Ferry	*Enterprise Landing*
Murrells Landing	*Bucksport Landing*
Sterritt Swamp	*Wachesaw Landing*
Conway Waterfront	*Hagley Plantation*
Pitch Landing	*Sampit River*
Source: Coastal Carolina University, Waccamaw Watershed Academy	

In 2008, the Waccamaw Watershed Academy expanded their water quality monitoring programming and began to collect samples and monitoring data at eight sites in the Murrells Inlet watershed. Sampling and data collection is also conducted at each of these sites twice per month throughout the year. The following water quality parameters are analyzed during each monitoring session: Alkalinity, Chlorophyll, Color, Conductivity, Dissolved Oxygen, E. Coli, Nitrate, pH, Phosphorus, Total Dissolved Solids, Temperature, and Turbidity.

Table 9-8 below provides a list of sites along the Murrells Inlet estuary that are monitored by the Murrells Inlet Volunteer Monitoring Project.

Table 9-8 Sites Monitored by the Murrells Inlet Volunteer Monitoring Project	
Woodland Drive Pond	*Harrellson Seafood*
Point Drive Canal	*Boat House Run*
Rum Gully Creek	*Bike Bridge*
Colony Marina Pond	*Oyster Landing Beach*
Source: Coastal Carolina University, Waccamaw Watershed Academy	

More recently in 2010, the Waccamaw Watershed Academy began a partnership with the Town of Surfside Beach Stormwater Committee and established three monitoring sites at the Woodland Drive, 4th Avenue North, and 11th Avenue North stormwater ponds and lakes within the town limits of Surfside Beach. Water samples are collected twice per month at all three of these monitoring sites. The following water quality parameters are analyzed during each data collection session: Conductivity, Salinity, pH, Dissolved Oxygen, Temperature, E.Coli, Fecal Coliform, and Total Nitrogen. In addition, the Waccamaw Watershed Academy has developed new partnerships with communities in Columbus and Brunswick counties in North Carolina to extend monitoring to upstream portions of the Waccamaw River basin to provide a basinwide assessment of water quality trends.

The Waccamaw Watershed Academy Volunteer Water Monitoring Program enhances the overall watershed management efforts of the Waccamaw region in several ways by:

- Engaging the public in water quality management efforts. Hands on activities such as a monitoring program is a valuable tool to increase public awareness regarding local water quality issues in our watersheds and to encourage citizens to have a stake in the health of our region's water resources. This direct engagement with the general public is an excellent strategy in promoting the stewardship of the Waccamaw River, Murrells Inlet, and in local communities such as Surfside Beach.

- In recent years, our local water resource managers have made great strides in coordinating management efforts to mitigate water quality impacts due to stormwater runoff and other non-point sources of pollution. The Waccamaw River Volunteer Monitoring Project is one example of the significant benefits realized by partnerships between our region's local and county governments, Coastal Carolina University, and non-profit stakeholder groups such as the Winyah Rivers Foundation. This volunteer water quality monitoring program fulfills requirements for public education and involvement stipulated by the NPDES Phase II permit program designed to address stormwater management issues.
- Having a regular local monitoring program in place allows water resource managers and government officials to evaluate improvements in water quality following the implementation of site-specific projects or other regulations and best management practices.

Additional information about the volunteer water quality monitoring program facilitated by the Waccamaw Watershed Academy at Coastal Carolina University can be found at: http://www.coastal.edu/wwa/vm/index.html

Santee Experimental Forest

The Center for Forested Wetlands Research operated by the US Department of Agriculture manages the Santee Experimental Forest research site that provides historic baseline data of the hydrology and ecology of a typical Atlantic Coastal Plain forested landscape. Research focuses primarily on ecological and hydrological response to fire behavior and sustainable silviculture practices. The monitoring efforts and research projects conducted at the Santee Experimental Forest have been beneficial resources in management and conservation efforts of the unique forested wetland ecosystems common in coastal South Carolina.

Additional information regarding the Santee Experimental Forest can be found at:
http://www.srs.fs.usda.gov/charleston/santee/index.html

MONITORING NEEDS AND STRATEGIES

Water quality monitoring provides the data that becomes the basis for decision-making in the state's permitting programs. Monitoring also helps facilitate other projects such as studies that investigate emerging water quality concerns, alternative management practices, and new technological developments. Monitoring is an indispensible tool in our region's comprehensive water quality planning and management efforts. This section identifies some ongoing needs and provides recommendations to enhance our monitoring capabilities and effectively utilize all available resources to improve management efforts.

State of South Carolina Monitoring Strategy

SC DHEC drafts an annual strategy that prioritizes water quality monitoring efforts throughout the state. The document has a list and corresponding description of all of the monitoring sites throughout the State of South Carolina. This is an important document as the monitoring capabilities of SC DHEC are often dependent on state government budget constraints. Monitoring priorities can shift according to resource availability and the urgency of various monitoring needs throughout the state.

The annual monitoring strategy outlines several key guiding principles and objectives, including the following:

- Determining water quality standards attainment
- Identifying impaired waters
- Identifying causes and sources of water quality impairments
- Establishing, reviewing, and revising water quality standards
- Supporting the implementation of water management programs

- Supporting the evaluation of program effectiveness
- Monitoring for water quality-based controls
- Monitoring for NPDES permit compliance and enforcement
- Making data readily available

The State of South Carolina Monitoring Strategy also outlines essential personnel, equipment, and support resources needed to achieve the objectives set forth by the state's water quality monitoring program. Resource item needs and desired program enhancements indicated in the 2011 State of South Carolina Monitoring Strategy include:

- Personnel to manage environmental data handling and processing for various reporting and programmatic purposes including managing data entry into the US EPA STORET system and selecting annual probability based monitoring site evaluation and documentation.
- Increase biological assessment capabilities to include the development of new non-wadeable stream macroinvertebrate community assessment methods, improve phytoplantkton and chlorophyll monitoring, expand fish tissue sampling program, and provide additional laboratory and field equipment to support all associated program activities.
- Development of a clean metals collection and analysis facility.
- Implementation of an ambient wetlands monitoring program.

The state's water quality monitoring program provides the backbone for a wide variety of permitting programs and other water quality management initiatives throughout the state. It is important for local management agencies in the Waccamaw region to be informed of the monitoring resources administered by the state. Local monitoring efforts should complement the resources available through SC DHEC and other state agencies. The State of South Carolina Monitoring Strategy can be accessed at: http://www.scdhec.gov/environment/water/docs/strategy.pdf

WATER QUALITY MONITORING GOALS AND RECOMMENDATIONS

The following section provides a list of goals and corresponding recommendations with respect to the water quality monitoring resources in the Waccamaw region. Several of these goals highlight the long-term monitoring needs for the region while other goals focus on the monitoring resources that are needed to address specific water quality issues in our region. Most of the goals promote the coordination of resources amongst multiple water resource management agencies.

Goal One: Continue to incorporate monitoring as an integral tool in water quality management efforts throughout the Waccamaw region. ***Recommendations include:***

- Continue to invest in monitoring resources to address water quality issues of particular concern to the Waccamaw region, such as salt water intrusion impacts, mercury fish tissue contamination, shellfish sanitation monitoring, and beach monitoring.
- Ensure that datasets that have been collected for extensive periods of time are maintained and not interrupted.
- Maintain a regional watershed approach in managing water quality monitoring programming. The Waccamaw region is directly affected by water quality issues in upstream portions of the Yadkin- Pee Dee River Basin. Evaluating water quality data collected by management and research agencies in North Carolina is important to assessing specific watershed management strategies that ought to be implemented in the Waccamaw region of South Carolina.
- Provide better monitoring data linkages between each of the regulatory programs pertaining to drinking water, stormwater management, wastewater treatment, etc. so that data collection and analysis is not

unnecessarily duplicated. This would also ensure that future investments in monitoring resources benefit multiple data users.

- Ensure that there is a direct and identifiable management strategy in place that responds to water quality data collected as part of a monitoring program or project. Avoid investing in water quality monitoring resources that are not ultimately utilized by an existing management agency.
- Make funding for water quality management projects and initiatives contingent upon the use of existing water quality data or the implementation of post-project monitoring.
- Submit a quality assurance project plan for monitoring programs, such as Coastal Carolina University's Waccamaw Watershed Academy, that have data collection capabilities sufficient enough to help support the regulatory programs administered by SC DHEC.
- Pursue the development of macroinvertebrate species composition inventories for various portions of the Yadkin-Pee Dee and Santee River Basins.

Goal Two: Build partnerships and establish initiatives similar to the SC Estuarine and Coastal Assessment Program and the USGS monitoring station federal cooperative fund sharing program. These types of partnerships are useful in sharing limited resources and pursuing new research projects that enhance our overall understanding of water quality conditions throughout the Waccamaw region. ***Recommendations include:***

- Pursue opportunities on a local, state, and regional level. Research projects in other coastal areas such as Florida, Georgia, North Carolina, and Virginia may have useful findings that can help address water quality concerns that are prevalent in the Waccamaw region.
- Utilize information gathered by monitoring research projects such as Clemson University's Intelligent River program. Although this project is primarily focused on the Savannah River watershed, technological applications implemented in this project could be worthwhile to incorporate into ongoing monitoring efforts in the Santee River and Yadkin-Pee Dee River basins.
- Promote partnerships between local governments, businesses, industries, neighborhood associations, federal agencies, and local research institutions. The Waccamaw region is fortunate to have a diverse and extensive group of water resource management agencies and stakeholders. Partnerships are vital to facilitating many types of projects and can result in mutual benefits for numerous local stakeholder entities.
- Utilize the International Stormwater BMP Database as an informational resource to help assess various management practices that could be utilized to address water quality issues in the Waccamaw region. It would also be very beneficial to contribute information about local management practices to the International Stormwater BMP Database. This would provide guidance to each water resource manager regarding the pros and cons of each type of treatment practice. This would also increase regional and national exposure on our local watershed management practices and enhances local networking opportunities with this national partnership program.

Goal Three: Creatively explore new funding strategies to cover the costs of maintaining a comprehensive water quality monitoring program in the Waccamaw region and the State of South Carolina. ***Recommendations include:***

- Conduct a comprehensive assessment of all users of information collected by the USGS monitoring station network. Historically, the regional wastewater treatment utility providers have accounted for the largest proportion of funding costs. Other USGS data users such as recreational fisherman and floodplain managers could potentially contribute through mechanisms such as the state's fishing license program and FEMA's National Flood Insurance Program. The hydrological and water quality data collected at the USGS monitoring stations are vital in the effective management of each of these programs.

- Consider funding beach and shellfish monitoring efforts via tourism-based revenue sources. Both the beach and the commercial shellfish industry are integral aspects of the local tourism economy and need to be managed in a sustainable way. Monitoring assists in providing adequate public health warnings and in identifying the source of the pollutant that may be contaminating these vital coastal resources.

Goal Four: Invest in research and monitoring resources to evaluate water quality issues of emerging concern. ***Recommendations include***:

- There are new indications that the chemical constituents in pharmaceuticals and personal care products are able to pass through the waste stream without being fully treated. Monitoring projects are important to determine potential environmental and public health impacts associated with the release of these chemical compounds into the environment.

Goal Five: Evaluate the need to institute post-construction monitoring requirements for various types of development projects. ***Recommendations include:***

- Encourage local governments to consider revising stormwater management ordinances to include provisions that would require developers to monitor on-site water quality following construction and other disturbance activities.

Goal Six: Conduct a thorough monitoring assessment as part of the TMDL development process. ***Recommendations include:***

- Invest in advanced assessment technologies so that the exact pollutant source and precise location of the observed impairment can be determined within the TMDL boundaries. This type of monitoring assessment is a cost effective way to narrow in on the pollutant of concern and properly invest in water quality best management practices to address the impairment issue.
- Utilize monitoring resources to regularly evaluate the effectiveness of the established TMDL. Monitoring can be utilized as part of an adaptive management strategy to accurately reassess the wasteload and load allocations of the TMDL and to identify new pollutant sources that may be contributing to the impairment.

Goal Seven: Collate results from ongoing monitoring efforts and evaluate current and future monitoring resource needs on a regular basis. ***Recommendations include:***

- Facilitate an annual meeting between relevant monitoring providers including SC DHEC and USGS to discuss current monitoring efforts and resource concerns.
- Incorporate the development of an annual summary report of existing monitoring efforts as part of the regular responsibility of the Section 208 program at the Waccamaw Regional COG. This would provide all program partners an opportunity to be fully aware of other monitoring efforts in the region. This annual report could potentially assist in developing new partnerships on research and management projects that require various monitoring resources.

Goal Eight: Continue to engage the general public in water quality monitoring projects throughout the Waccamaw region. This activity is an effective hands-on educational strategy that allows water resource managers to share information regarding water quality conditions and issues in our local watersheds. It also enhances community pride and stewardship by facilitating an opportunity for residents to get directly involved in watershed management activities in their own communities. ***Recommendations include:***

- Expand the Waccamaw Watershed Academy Volunteer Monitoring Program to new locations within the Waccamaw region. Incorporate additional bioindicator monitoring techniques, to allow for certain target groups, such as public schools, to participate on a more flexible schedule.

- Encourage local governments, schools, neighborhood associations, and other interested stakeholders to participate in state, national, and global educational and awareness initiatives such as the World Water Monitoring Day (www.worldwatermonitoringday.org)

Goal Nine: Encourage collaboration amongst all stakeholders as new water quality regulations are developed in the future. ***Recommendations include:***

- Encourage all water resource managers within the Waccamaw region to participate in the triennial review of the South Carolina Water Classification and Standards.
- Other states have developed numeric surface water quality standards for common nutrients such as nitrogen and phosphorus. It is quite possible that the State of South Carolina will proceed with developing numeric standards for Nitrogen and Phosphorus as well. These potential regulations would have significant implications on both point source management agencies and non-point management agencies. An active and thorough dialogue between all relevant stakeholders is essential for understanding the underlying causes of nutrient impairments and for identifying the most cost-effective and practical solutions for mitigating sources of nutrient loadings to our surface waterbodies. This initial dialogue will have long-term benefits in situations where future TMDLs are developed for various waterbodies throughout the state.
- Collaboration is essential when considering other water quality pollution concerns such as the presence of endocrine disrupting compounds in the natural environment. It is possible within the twenty year time horizon of this plan, that numeric criteria could be developed for these contaminants of emerging concern. The federal government has begun to conduct research investigations led by the US EPA and USGS to analyze environmental impacts caused by endocrine disrupting compounds and to assess the application of various technologies, in particular at wastewater treatment facilities to remove these byproducts from the waste stream. These research and monitoring efforts are going to have tremendous implications on future management strategies to address these concerns. Public awareness is critical in these efforts as well because the general public may have a significant role in preventing these chemical constituents from entering the waste stream or directly to the natural environment.
- The development and implementation of TMDLs also requires collaboration amongst several management entities in a watershed. Rarely are water quality impairments caused by one single pollutant source. The wasteload allocation and load allocation processes rely heavily on cooperation amongst all stakeholders, including point-source and non-point source management agencies, to implement measures to address each particular water quality impairment.

Chapter Ten: Public Education and Outreach Programs

Citizens play an important role in helping local communities maintain good water quality within our watersheds. Not only do citizens need to be informed of water quality impairments that pose public health risks, they also need to be aware of the impacts their daily activities can have on the environmental health of our waterways. Public outreach is an essential strategy in providing basic information about water quality related issues and to extend opportunities for citizens to become stewards of their local watershed and participate in initiatives aimed at protecting local water resources.

Fortunately, there are many active public outreach entities within the Waccamaw region to help educate local residents and visitors about the region's watersheds and the importance of protecting this natural resource. This chapter highlights the importance of public outreach and awareness as part of the overall water quality management efforts in the Waccamaw region. This chapter also profiles many of the existing resources that are in place to educate the general public and local decision makers about various water quality issues in the region. Finally, a set of goals are established which provides direction and a general strategy of how to meet the region's long-term public outreach needs.

EXISTING PUBLIC OUTREACH RESOURCES

Water is one of the most precious and essential natural resources to our society. All citizens are dependent on clean water for their daily activities and to fulfill their basic human health needs. Our water resources are sensitive to contamination from a wide range of pollutant sources, which can threaten the quality of life for all of us. Each of us has a responsibility to help our communities protect this vital resource. Water quality is influenced in part by the decisions and behaviors of individual residents. Public outreach efforts are an important way to educate citizens about the region's watersheds and the efforts needed to ensure that the water quality in our rivers and streams are protected. Outreach programming can provide citizens information on ways they can help protect local water resources. A primary objective of public outreach efforts is to foster a stewardship ethic amongst individual citizens so that they can become a well informed stakeholder in ensuring that water resources are valued and remain well protected.

Below is a profile of several entities that are active in providing citizens, and local government officials the information necessary to address issues concerning the region's water quality.

Coastal Waccamaw Stormwater Education Consortium

The Coastal Waccamaw Stormwater Education Consortium (CWSEC) was established in 2004 to develop and implement effective, results-oriented stormwater education and outreach programs to meet federal requirements and satisfy local environmental and economic needs in communities located in northeast South Carolina. Consortium partner members include the following local governments; City of North Myrtle Beach, Town of Atlantic Beach, Town of Briarcliffe Acres, City of Myrtle Beach, Town of Surfside Beach, City of Conway, Horry County, and Georgetown County. These local governments contract with CWSEC for activities, led by education providers and tailored to meet specific needs of each community. Participating education providers include Clemson University's Carolina Clear, Coastal Carolina University's Waccamaw Watershed Academy, Murrells Inlet 2020, North Inlet- Winyah Bay National Estuarine Research Reserve, Winyah Rivers Foundation's Waccamaw Riverkeeper, and the South Carolina Sea Grant program. The CWSEC works to fulfill designated MS4 community NPDES Phase II permit

requirements for minimum control measure one, public education and outreach, and minimum control measure two, public involvement. CWSEC activities for minimum control measure one, public education and outreach, include stormwater education workshops for local officials, property and home owner associations and property management companies, and students; in-depth training sessions on specific best management practices; marketing on television, billboard and radio; and direct technical assistance for each MS4 community. CWSEC continues to expand its public involvement and participation projects to fulfill minimum control measure two permit requirements. Activities include river and beach sweep events, rain garden installations at regional schools and public facilities, volunteer water quality monitoring, and via a stormdrain marking program.

Through a regional watershed based approach, the CWSEC will continue to be an invaluable asset to water resource managers and local government officials as they seek collaborative opportunities to address ongoing stormwater management challenges in the coastal Waccamaw area. For more information, the Consortium's website is http://www.cwsec-sc.org/

Clemson University, Carolina Clear Program

Carolina Clear is a public outreach campaign to educate communities throughout South Carolina about water quality issues that affect the state. Carolina Clear seeks to build partnerships to meet the watershed educational awareness needs in local communities. These collaborations have led to many successful mass media campaigns such as the "We all live downstream" billboard program, in addition to television and radio public service announcements. Carolina Clear also produces useful literature geared towards homeowners such as the "South Carolina Rain Garden Manual". Another innovative project sponsored by Carolina Clear is the South Carolina Low Impact Development (LID) Atlas, developed by the National Nonpoint Education for Municipal Officials Network. This online mapping tool allows website users to locate sites where LID practices are being implemented. LID practices that are highlighted include Green Roofs, Rain Barrels, Permeable Pavement, Bioswales, etc. Carolina Clear also organizes and facilitates workshops throughout the state as a direct outreach initiative. The Carolina Clear program provides enormous support to existing public outreach efforts in the Waccamaw region. More information about events and resources provided by the Carolina Clear program can be found online at: http://www.clemson.edu/public/carolinaclear/

North Inlet- Winyah Bay National Estuarine Research Reserve, Coastal Training Program

The North Inlet- Winyah Bay National Estuarine Research Reserve (NERR) is part of a national network of programs dedicated to the stewardship of our nation's estuarine ecosystems through scientific research and education. The North Inlet- Winyah Bay NERR oversees the Coastal Training Program and the K-12 and Public Education Program to help address coastal water quality issues in the Waccamaw region.

The Coastal Training Program is a technical assistance initiative that provides science based training to local decision-makers and professionals in the planning, economic development, and engineering fields. Training events include on-site demonstrations and mobile workshops, seminars, and presentations. The program offers training on a wide range of topics relevant to the region's coastal environment including Low Impact Development, coastal erosion and climate

change impacts, stormwater management practices, wetland protection, and many other important topics. Participants can learn about new initiatives and programs, technological developments, and current public policy implications from experts in their respective fields. The Coastal Training Program provides an essential service to those who work in water quality related fields. More information about the Coast Training Program can be found online at: http://www.northinlet.sc.edu/training/index.html

The North Inlet- Winyah Bay NERR also offers unique learning experiences for audiences of all ages through its K-12 and Public Education programming. These programs focus on K-12 and general public environmental education with an emphasis on coastal and estuarine ecology and watershed concepts. The program is structured to provide both formal classroom workshops and hands-on learning experiences to foster citizen stewardship of our coastal resources. The K-12 and Public Education Program also organizes several annual events including "National Estuaries Day" and "Teachers on the Estuary". The NERR also offers volunteer opportunities to assist with current research projects that are being conducted at the Reserve. An ongoing volunteer project is the "Fishes of the North Inlet Estuary" program, where participants assist scientists in the sorting, measurement, and weighing of aquatic species collected as part of a long-term survey initiated in 1984. More information about the K-12 and Public Education programs hosted at the North Inlet-Winyah Bay NERR can be found online at: http://www.northinlet.sc.edu/education/index.html.

Winyah Rivers Foundation

The Winyah Rivers Foundation is a local grassroots watershed organization that is active in protecting the health of our coastal watershed system through educational outreach initiatives, community service projects, and general advocacy for the sound management of our region's river network. The Winyah Rivers Foundation is a member of the national Waterkeeper Alliance Network. The Waccamaw Riverkeeper Program is an entity through which concerned citizens can contribute to water quality monitoring activities and participate in litter cleanup and river restoration community service events. The program also hosts an annual Waccamaw River Conference to showcase current efforts at studying and protecting local and regional watershed resources. The Waccamaw Riverkeeper Program has effectively established numerous partnerships throughout the Waccamaw region to enhance stakeholder involvement and public awareness regarding water quality issues in our local watersheds. More information about the Winyah Rivers Foundation can be found online at: http://www.winyahrivers.org/

Coastal Carolina University, Waccamaw Watershed Academy

The Waccamaw Watershed Academy was established in 2004 to address several water quality management and public outreach needs in the greater coastal South Carolina region. One effective strategy to engage concerned citizens is the Volunteer Water Monitoring Program. Trained volunteers follow quality control procedural guidelines issued by the US EPA to obtain water samples from twelve monitoring sites along the Waccamaw River and eight monitoring sites in Murrells Inlet. The water samples are tested for several water quality standard parameters including pH, E.Coli, temperature, conductivity, and dissolved oxygen. Coastal Carolina University supports the Waccamaw Watershed Academy initiatives with research laboratory facility space and faculty support. This university-community partnership is a great asset to help build a long-term foundation for community stewardship and advance scientific understanding of our local watershed resources. More information about the Waccamaw Watershed Academy can be found online at: http://www.coastal.edu/wwa/

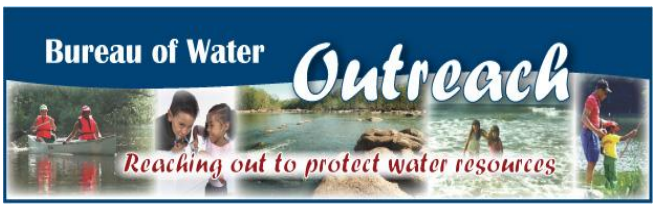
Water and Sewer Utility Providers

The water and sewer utility providers have a vital role in providing the general public information about the quality of our local drinking water supply and wastewater effluent. Municipal governments and each special purpose district provide annual water quality reports on their websites for public view. They also conduct periodic customer satisfaction surveys and post the results online. They have also been proactive in providing guidance on water conservation initiatives such as proper irrigation use to help the general public understand the importance of using our water resources prudently and sustainably. Most of the capital improvement projects initiated by the local water and sewer districts are subject to permit conditions established by SC DHEC. Public notice procedures are an integral aspect of the approval process for major projects proposed by each utility. The general public can also view recent discharge monitoring reports for every NPDES permitted point source discharge facility via US EPA's permit compliance system database at: http://www.epa.gov/enviro/facts/pcs/search.html

SC Department of Health and Environmental Control

As the lead state agency charged with protecting public health and water quality within the State of South Carolina, SC DHEC has an important public outreach role, which is vital to effectively executing its mission. Many programs administered by SC DHEC entail direct public notice, such as the fish consumption and swimming advisory systems. These programs specifically aim to protect the health of the general public. Other outreach efforts such as the South Carolina Green Guide and the Water Sense program are designed to encourage South Carolina residents to take direct action in minimizing individual impacts on the environment. Another important responsibility of SC DHEC is to monitor the water quality in surface waterbodies and groundwater systems to determine if water quality standards are being attained throughout the state. In addition, SC DHEC administers and enforces the NPDES permit program in the State of South Carolina. Decisions from both of these programs can have substantial ramifications for industries, local communities, the general public, and the health of the natural environment. These decisions often entail a tremendous amount of public outreach to sufficiently explain the implications of a specific water quality impairment or the conditions of a particular permit that is issued. Responding to citizen concerns is an integral aspect of the responsibilities of SC DHEC.

Resources available through SC DHEC's Water Outreach Program can be accessed via: http://www.scdhec.gov/environment/water/or.htm



US Environmental Protection Agency

The US Environmental Protection Agency is the hub of a wealth of information regarding watershed resources throughout the country. As one of the lead federal agencies responsible for administering and enforcing the federal environmental laws of the United States, the decisions made by US EPA have consequences for all local water resource management agencies. The US EPA is also the lead entity in promoting nationwide water quality management programs including initiatives with significant public outreach components. Some recognizable public engagement programs that US EPA oversees are the Adopt your Watershed program and the Water Sense program. The US EPA is also a central resource for scientific databases and research reports, making the agency a vital source of case studies and information about best management practices implemented by watershed management programs and projects throughout the United States.

The following link provides resources to enable all citizens to take proactive measures to help protect our nation's water resources: http://water.epa.gov/action/

PUBLIC OUTREACH GOALS AND RECOMMENDATIONS

Water quality education and stewardship programs will continue to be an important aspect of the Waccamaw region's water quality management efforts. There are many local and state organizations and management entities that can help meet the region's public outreach needs. It is paramount that existing partnerships continue to be sustained and resources should remain well coordinated to meet future public outreach goals. The following section provides a list of goals and corresponding recommendations for water quality public outreach programming in the Waccamaw region. Several goals are intended to address public awareness needs for specific water quality issues. Other goals are intended to foster a greater awareness of the social, economic, and environmental value of local water resources and encourage residents and visitors to become active stewards of our rivers, estuaries, and beaches. While these recommendations are intended to address the current education and outreach needs of the region, regular evaluation of the effectiveness of our regional outreach programming should occur so that all ongoing efforts and new initiatives remain as effective as possible.

Goal One: Continue to strategically develop and coordinate the implementation of public information and education programs that target diverse population groups including children, new residents, tourists, businesses, and local decision-makers. ***Recommendations include:***

- Periodically conduct survey research to evaluate the perceptions and concerns the general public has concerning water quality issues and management efforts in the Waccamaw region.
- Ensure that public awareness efforts have a site scale level of analysis. Typically, there are distinct water quality concerns that pertain to each type of waterbody within the Waccamaw region, including the local estuaries, tidal swashes, beaches, wetlands and the larger river systems. As a result, each waterbody requires its own management strategy.
- Maintain a long-term perspective on local official training and public awareness needs to address water quality issues that require a long-range timeframe management strategy such as saltwater intrusion and climate change.
- Promote collaboration amongst all local governments, sewer utility districts, research institutions, and non-profit organizations to share resources for various public education initiatives. This approach helps to enhance the

quality of public awareness programming and increases the size of the target audience for each public outreach initiative.

- Consider developing a quarterly or semi-annual water quality forum to allow water resource managers throughout the region to actively discuss various water quality topics concerning the Waccamaw region.
- Ensure that outreach materials also target non-english speaking residents and visitors.

Goal Two: Utilize traditional and emerging media outlets to promote stewardship of our water resources amongst permanent residents and visitors alike.

- Continue to utilize multiple approaches to target the general public including television and radio campaigns, billboard messages, informational flyers, and internet based resources.
- Continue to install interpretive sign information about local watersheds and native aquatic species at regularly used boat landings and fishing piers.
- Work with SC DOT to install road signs indicating to motorists that they are entering a particular watershed. Continue to work with local communities to expand the storm drain marking awareness program.
- Consider coordinating with local hoteliers and real estate rental agencies to distribute water quality protection literature specific to the Waccamaw region to visitors of the area.

Goal Three: Continue to invest in hands-on field activities and stewardship initiatives as a way to directly engage citizens in local watershed management efforts. ***Recommendations include:***

- Continue to utilize the Waccamaw Watershed Academy volunteer monitoring program as a way to enhance citizen knowledge about the condition of local water resources.
- Continue to partner with local schools and non-profit organizations in fieldwork projects to enhance the service learning opportunities in the region.
- Develop local adopt a stream and adopt a landing programs in the Waccamaw region.

Goal Four: Continue to develop training programs targeting local government officials and the development community that encourage the incorporation of sustainable development practices in our local communities. ***Recommendations include:***

- Work with local governments to strengthen local stream and wetland buffer, landscape, and zoning ordinances that aim to protect the sensitive water resources in the Waccamaw region.
- Continue to promote Low Impact Development practices, such as the reduction of impervious surfaces and the installation of rain gardens.
- Consider developing a recognition program that highlights innovative design practices that help to protect the water quality in the Waccamaw region.

Goal Five: Foster water quality protection and stewardship practices amongst the local business community. ***Recommendations include:***

- Encourage local communities to consider developing an eco-friendly recognition program for businesses that are engaged in activities that help protect water quality in the Waccamaw region. A good example of this type of program is the City of Conway's River-Friendly Business program, which utilizes a point-based criteria system to promote various housekeeping practices, such as proper landscaping techniques, water conservation efforts, sustainable product procurement, etc.

- Consider developing a local ecotourism certification program for tourism related vendors and businesses to provide recognition and increased market exposure for their sustainable practices.

Goal Six: Target direct outreach efforts to reduce and remediate illicit discharges and other specific water quality issues. ***Recommendations include:***

- Ensure that the general public has the proper contact information readily available to report incidents of pollution in our waterways.
- Provide homeowners and property managers with information on the importance of maintaining septic systems. ***Additional recommendations to address homeowner education and awareness needs regarding septic system maintenance are provided in Chapter Eight.***
- Encourage area restaurants to properly maintain their grease interceptors and avoid the disposal of fats, oils, and grease cooking byproducts into the sewer system. Extend this awareness effort to the general public. Avoiding the disposal of fats, oils, and grease byproducts into the sewer system saves the local sewer utility significant financial costs associated with repairing clogged sewer lines. Preventing sewer line clogs also minimizes customer inconveniences associated with service interruption and the potential for sanitary sewer overflow events.
- Enhance public awareness concerning the proper disposal of certain waste byproducts into the centralized sewer waste stream. An emerging water quality issue that researchers are just beginning to understand is the increasing presence of residual organic wastewater compounds found in our aquatic habitats. Although the long-term effects on public health and the natural environment are not fully understood, recent studies indicate that some fish species have shown detrimental physical impacts due to exposure to these chemical compounds. The primary source of many of these compounds are pharmaceuticals and personal care products that pass through the waste stream at wastewater treatment facilities. Given our present understanding of the environmental pathways of these compounds, it is essential to raise public awareness about the proper disposal of these household products. Long-term cooperation with the general public is likely going to be necessary as we continue to gain further knowledge and practical understanding about this water quality concern.

This Page Has Been Left Blank Intentionally

Chapter Eleven: Section 208 Program and Administrative Procedures

BACKGROUND

The Waccamaw Regional Council of Governments has been the lead entity in developing and updating the Section 208 Water Quality Management Plan for the Waccamaw region since the mid-1970s. The Waccamaw Regional COG has maintained a Section 208 Water Quality Program to administer initiatives and to implement objectives outlined in the Section 208 Water Quality Management Plan. Most of the general administrative tasks of the Section 208 Water Quality Program pertain to the coordination of wastewater treatment permitting issues and proposals. A Memorandum of Agreement has been established between SC DHEC and the Waccamaw Regional COG to review all proposed wastewater construction projects to determine conformance with the Section 208 Water Quality Management Plan. More details regarding this memorandum of agreement and the conformance review process are provided below. The Waccamaw Regional COG recognizes the enormous challenge of managing non-point sources of pollution and outlines many objectives in this Section 208 Water Quality Management Plan to enhance the COG's abilities to serve as a partner in regional efforts to address these water quality issues in the Waccamaw region.

This chapter provides an overview of the structure of the Waccamaw Region Section 208 Water Quality Program and the administrative procedures that the Waccamaw Regional COG follows when reviewing Section 208 Plan Amendments, Total Maximum Daily Load allocations, Section 208 conformance certification applications, and other projects that require SC DHEC permit review.

POINT SOURCE DESIGNATED MANAGEMENT AGENCIES

The Section 208 Plan establishes designated point source management agencies which have the legal authority to plan, construct, operate, and maintain publicly-owned wastewater collection, treatment, and disposal facilities. Other responsibilities of designated point source management agencies include:

- Carry out the appropriate requirements of the area wide water quality management plan for their respective designated planning areas.
- Effectively manage wastewater treatment facilities in their respective designated planning areas.
- Accept and utilize grants, or other sources of funding for wastewater treatment purposes. Only designated management agencies are eligible for low-interest loans from the State Revolving Fund (SRF) program for construction or repair of wastewater treatment systems.
- Raise revenues, including the assessment of wastewater treatment service charges.
- Incur short and long-term indebtedness.
- Refuse to receive any wastes from any municipality or subdivision which does not comply with any provision of an approved plan.
- Accept industrial wastes for treatment.

In addition, each respective designated point source management agency must fulfill the following responsibilities:

A. Establish or continue to implement a regulatory program to manage or determine:
    1. Location of domestic waste treatment facilities. State revolving funds are contingent upon this measure.
    2. Appropriate waste treatment policies and procedures including:

a. A schedule of fair user charges.
b. Pretreatment standards for industrial wastes and regulatory controls to accept or refuse municipal and/or industrial waste.
c. Other policies and procedures as may be appropriate.

3. Oversee the implementation of the state and US EPA approved area wide facilities waste treatment plan and updating the facilities plan periodically as necessary and appropriate.

B. Develop or continue to implement an effective series of administrative procedures and manage a personnel system capable to staff the agency in order to execute its duties and responsibilities.

Below is a list and brief overview of all the designated point source management agencies in the Waccamaw region:

Horry County:

City of Conway- Maintains collection system only, wastewater treated at Grand Strand WSA/Conway WWTF.

Little River Water and Sewer Company- Maintains collection system only, wastewater pumped to Grand Strand WSA/ Vereen WWTF for treatment.

City of Loris- Maintains collection system only, wastewater treated at Grand Strand WSA/ Loris WWTF.

City of Myrtle Beach- Maintains collection system only, wastewater treated at Grand Strand WSA/ Schwartz-Myrtle Beach WWTF.

City of North Myrtle Beach- Maintains collection system in North Myrtle Beach, Atlantic Beach, and Briarcliffe Acres. North Myrtle Beach also operates and maintains the Crescent Beach WWTF and the Ocean Drive WWTF.

Grand Strand Water and Sewer Authority- Maintains collection system in all unincorporated portions of Horry County, the Town of Aynor, and in the Town of Surfside Beach. Grand Strand WSA owns and operates the following wastewater treatment facilities in the Waccamaw region:

- **Schwartz WWTF**- located in the Burgess community of Horry County. This plant receives and treats wastewater collected from the old Myrtle Beach Air Force Base south to Garden City and inland to Carolina Forest and the Coastal Carolina University area, including the Forestbrook and Socastee communities in Horry County.
- **Myrtle Beach WWTF**- located at the end of Mr. Joe White Ave. in Myrtle Beach. This plant receives and treats wastewater collected in the City of Myrtle Beach. Treated effluent from this facility is discharged via the same outfall as the Schwartz WWTF to the Waccamaw River near the Georgetown County line.
- **Vereen WWTF-** located in the Wampee community of Horry County. This plant receives and treats wastewater collected from Little River, Longs, the northern portion of Carolina Forest, and Wampee.
- **Conway WWTF-** located near Lake Busbee in the City of Conway. This plant receives and treats wastewater collected from the City of Conway, the Town of Aynor, and large portions of western Horry County.
- **Loris WWTF-** located in the western part of the city. This plant receives and treats wastewater collected within the city limits and the immediate surrounding areas of Loris.
- **Bucksport WWTF-** located in the southern end of the Bucksport community of Horry County. This plant receives and treats wastewater collected from the Bucksport community and the immediate surrounding areas.

- **Longs WWTF-** located in the Longs community of Horry County. This plant receives and treats wastewater collected from the Longs community. Since 2008, treated effluent from the Longs WWTF has been diverted to the Vereen WWTF for ultimate discharge.

Grand Strand WSA also operates and maintains several land application sites in Horry County. A brief overview of each facility is provided below:

- **Green Sea- Floyds WWTF-** This 66 acre site is located off of Hwy 9 near Green Sea-Floyds High School. This plant serves the high school and the immediate surrounding area and is permitted as a land application site.
- **Bucksport/ Tip Top Regional WWTF-** This recently permitted facility is still in the final engineering and design phases. Once constructed, this 10 MGD wastewater treatment facility will receive and treat wastewater collected from the City of Conway, western Horry County, as well as the Bucksport community. The facility will utilize a rapid infiltration basin system for ultimate disposal of treated effluent.
- **Socastee Sod Farm-** This 415 acre site is used for the disposal of treated biosolids from the Schwartz WWTF.
- **Bucksport Sod Farm-** This 490 acre site is used to dispose alum sludge and backwash water from the Bull Creek Surface Water Treatment Plant and the Myrtle Beach water plant, along with treated biosolids from several of the agency's smaller wastewater treatment facilities.
- **Tip Top Tree Farm-** This 4,464 acre site is permitted to receive up to 10.5 MGD of treated effluent from the Schwartz and Bucksport WWTFs. The site is also permitted to receive biosolids for ultimate beneficial reuse.
- **Yauhannah Tract-** This 3,226 acre site has been permitted as a biosolids reuse disposal site since it was purchased in 2004.
- **Carolina Bays-** This 700 acre complex is part of the Vereen WWTF site and is currently used as a backup disposal site for treated effluent.

Georgetown County:

***Town of Andrews*-** Maintains collection system only, wastewater treated at the City of Georgetown WWTF.

***City of Georgetown*-** Maintains the collection system within the city limits of Georgetown and operates the City of Georgetown WWTF.

***Georgetown County Water and Sewer District*-** Maintains the collection system in all parts of the unincorporated portions of Georgetown County and the Town of Pawleys Island. Effluent is treated at the following wastewater treatment facilities.

- **City of Georgetown WWTF-** Wastewater in the unincorporated portions of the Georgetown 201 planning area is collected by Georgetown County WSD and pumped to the City of Georgetown WWTF for treatment.
- **Murrells Inlet WWTF-** serves the northeast portion of Georgetown County.
- **Pawleys Area WWTF-** serves the Litchfield Beach and Pawleys Island portions of Georgetown County.
- **Debordieu WWTF-** serves the Debordieu Planned Unit Development portion of Georgetown County. This facility primarily utilizes a land application system to dispose treated effluent to the Debordieu golf course. This facility is also permitted to discharge to the Waccamaw River under specific contingency conditions.
- **North Santee WWTF-** serves the North Santee community in Georgetown County.

Williamsburg County:

Town of Hemingway- Maintains collection system and operates the Hemingway WWTF.

Town of Greeleyville- Maintains collection system and operates the Greeleyville WWTF. The Greeleyville WWTF is permitted as a land application system.

Town of Kingstree- Maintains collection system and operates the Kingstree WWTF.

Williamsburg County Water and Sewer Authority- Maintains the collection system in the unincorporated areas of the Hemingway and Kingstree 201 planning areas. Williamsburg County WSA also operates the Williamsburg Co/Santee River WWTF.

Exhibit 11.1 is a map of the existing Section 208 service boundaries for each designated point source management agency in the Waccamaw region. **Exhibit 11.2** identifies all of the designated point source and non-point source management agencies in the Waccamaw region.

If a designated point source management agency desires to transfer the provision of wastewater service within their Section 208 service boundaries to another designated point source management agency, then both agencies must agree to a new modified service boundary or to an interlocal service agreement. These modifications can be approved when all affected parties are in full mutual agreement and sufficient documentation of this agreement can be provided. This agreement is subject to a Section 208 Plan Amendment approval and subsequent SC DHEC review and approval. Full details regarding Section 208 amendment procedures are provided later in this chapter.

NON-POINT SOURCE POLLUTION DESIGNATED MANAGEMENT AGENCIES

In recognition of the severity of non-point source pollution and the need for additional resources to manage these water quality issues, the 1998 Waccamaw Region Section 208 Water Quality Management Plan identified appropriate non-point source management entities in the Waccamaw region. The rationale was that the designated non-point source management agency had to have the authority to execute various planning and management strategies such as:

- Adopt land use controls, such as zoning and subdivision regulations.
- Adopt erosion and sediment control ordinances, stormwater management ordinances, and solid waste regulations to minimize the impacts of runoff on the water quality of waterbodies located within each management agency's jurisdictional boundaries.
- The ability to enforce all instituted ordinances and regulations.

Beginning in 1999, US EPA expanded the MS4 stormwater permitting program to Phase II, which required small urbanized areas to be covered by the NPDES stormwater general permit program. Local governments designated under the small MS4 permit program are required to develop and implement a stormwater management plan for their respective jurisdictions. SC DHEC established the Myrtle Beach Urbanized Area as a Regulated Small MS4, which includes the Forestbrook, Garden City, Little River, Murrells Inlet, Red Hill and Socastee CDPs. Local governments within this designated urbanized area include Atlantic Beach, Briarcliffe Acres, Conway, Georgetown County, Horry County, Myrtle Beach, North Myrtle Beach, and Surfside Beach. More details regarding the MS4 NPDES permit program is provided in **Chapter Seven, Nonpoint Source Pollution.**

Exhibit 11.1 Waccamaw Region 208 Planning Boundaries- Point Source Management Agencies

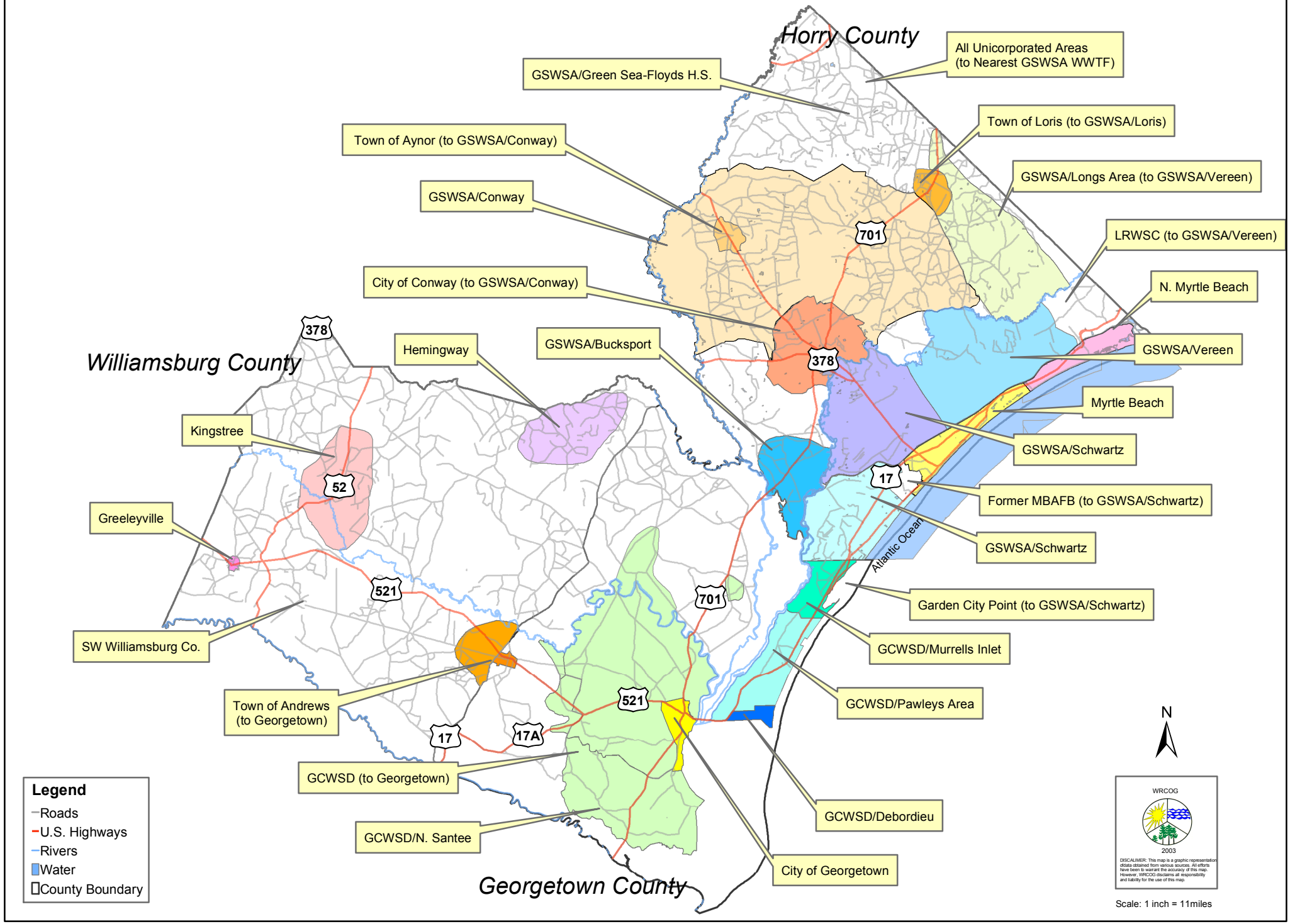
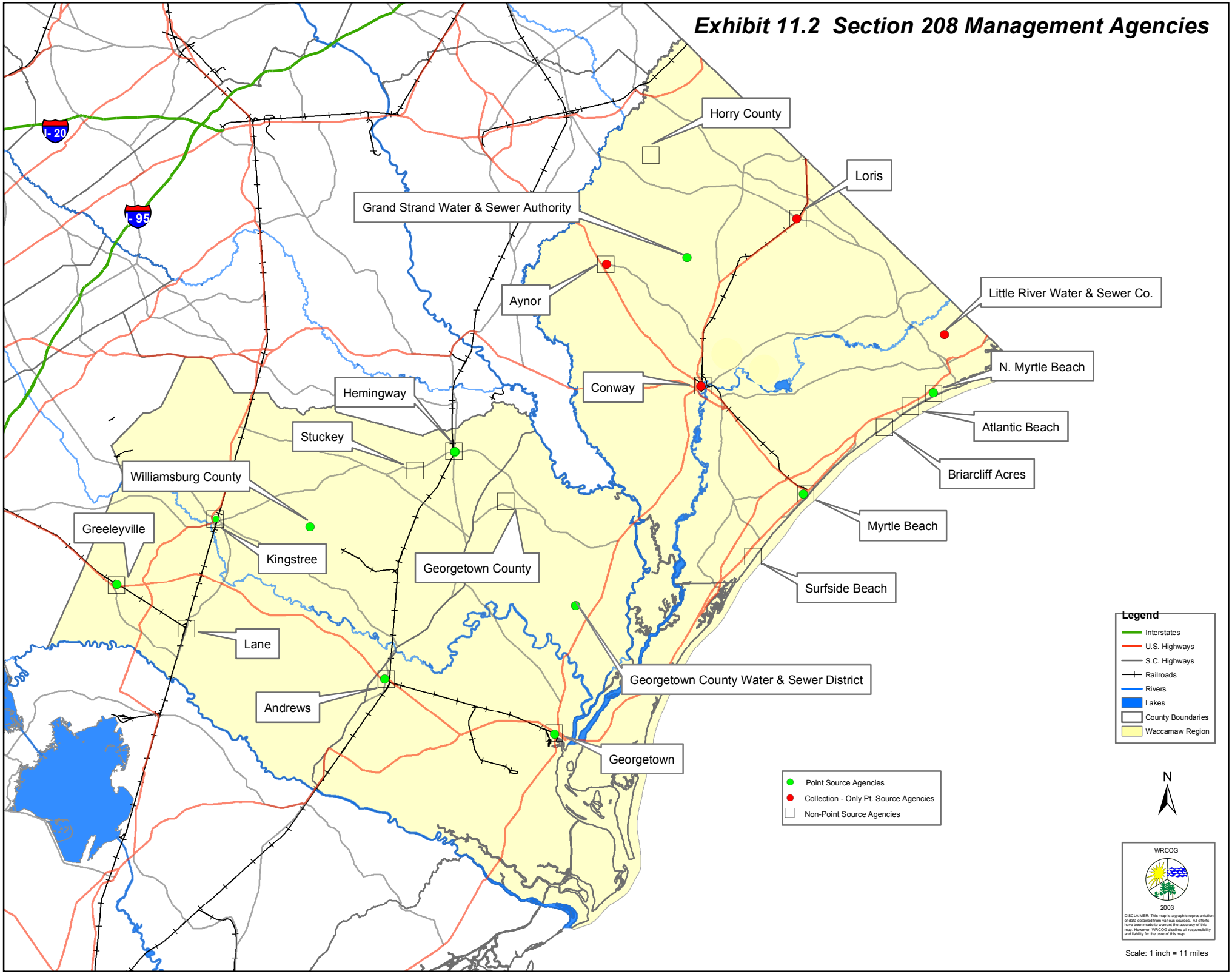


Exhibit 11.2 Section 208 Management Agencies



Local governments outside of the Myrtle Beach Urbanized Area MS4 permit boundary have responsibilities to minimize impacts from non-point sources of pollution as well. Therefore the Section 208 Plan establishes the following designated non-point management agencies in the Waccamaw region:

Horry County:

- ***Town of Atlantic Beach***
- ***Town of Aynor***
- ***Town of Briarcliffe Acres***
- ***City of Conway***
- ***Town of Loris***
- ***City of Myrtle Beach***
- ***City of North Myrtle Beach***
- ***Town of Surfside Beach***
- ***Horry County***

Georgetown County:

- ***Town of Andrews***
- ***City of Georgetown***
- ***Town of Pawleys Island***
- ***Georgetown County***

Williamsburg County:

- ***Town of Greeleyville***
- ***Town of Hemingway***
- ***Town of Kingstree***
- ***Town of Lane***
- ***Town of Stuckey***
- ***Williamsburg County***

SECTION 208 CONFORMANCE REVIEW PROCEDURES

Under an ongoing Memorandum of Agreement with SC DHEC, all proposed wastewater construction projects, new and reissued NPDES permits, new and reissued No Discharge (ND) permits, and wastewater facility plans or updates that occur in Horry, Georgetown, or Williamsburg Counties must be reviewed by the Waccamaw Regional Council of Governments. The purpose of the review is to determine whether each proposed project or permit is in conformance with the Waccamaw Region Section 208 Plan. A Section 208 Plan conformance review is a required step in SC DHEC's permit issuance procedures. If a proposed project or permit is found not to be in conformance with the Waccamaw Region Section 208 Plan, a plan amendment may be pursued by the applicable designated point source management agency. A summary of plan amendment procedures is provided later in this chapter.

ANNUAL SECTION 208 PLAN UPDATE

In accordance with the federal Clean Water Act, an annual update of activities pertaining to the Section 208 Plan must be submitted to SC DHEC for their review. Submission of this annual report is a requirement outlined in the 205j contract arrangement between SC DHEC and the Waccamaw Regional COG.

Items to be included in this annual update include the following:

- A list of approved and denied Section 208 Plan conformance reviews completed in the past fiscal year
- Summary of all approved Section 208 Plan amendments
- A description of any Section 208 Planning boundary changes
- A summary of any new or revised interlocal wastewater treatment agreements
- Updated population and land use projections if available
- Changes in management agency designations or responsibilities

SECTION 208 PLAN AMENDMENT PROCEDURES

Wastewater treatment needs change periodically based on several varying factors including population growth, service agreement modifications between designated point source management agencies, the development of new wastewater treatment technologies, TMDL discharge allocations, etc. The Waccamaw Region Section 208 Water Quality Management Plan accommodates these changes in wastewater management via a Section 208 amendment procedure. A summary of all Section 208 Plan Amendments approved since fiscal year 1999 is provided in **Appendix J**. The following section describes what constitutes the need for a Section 208 Plan amendment and the protocol for approving each proposed Section 208 Plan Amendment.

Section 208 Plan Amendments can be classified as a Major Amendment or a Minor Amendment.

A **Minor Amendment** is required for the following types of activities:

A. An expansion of an existing wastewater treatment facility that proposes to increase current design capacity by less than 50% and less than 10 million gallons per day.
B. Conversion of an existing wastewater treatment facility to another use such as an equalization or storage basin.
C. A facility upgrade that enables a wastewater treatment facility to handle a higher design flow without increasing the Ultimate Oxygen Demand wasteload to the receiving waterbody.
D. A proposed change in the current effluent disposal method or discharge location for an existing wastewater treatment facility.
E. The modification of an existing interlocal agreement between two or more designated point source management agencies regarding service provision, bulk treatment of wastewater, joint use of wastewater discharge line, or other agreement pertaining to wastewater management.
F. Any other proposals SC DHEC considers minor with regard to water quality effects or stakeholder interest.

A **Major Amendment** is required for the following types of wastewater treatment proposals:

A. Proposals affecting the service areas of two or more designated management agencies, which do not include appropriate prior agreements between those management agencies.
B. The construction of a new wastewater treatment facility, including land application sites.
C. An expansion of an existing wastewater treatment facility that proposes to increase current design capacity by at least 50% or by 10 million gallons per day or greater.

D. An expansion of an existing WWTF which involves an increase in the presently permitted Ultimate Oxygen Demand wasteload which can be discharged to a receiving stream.
E. Proposed projects which conflict with the following goals and objectives of the Waccamaw Region Section 208 Water Quality Management Plan:
    1. To maintain or improve the water quality of surface waters and groundwaters in the Waccamaw region.
    2. To consolidate small or privately-owned wastewater treatment facilities into larger regional facilities to be owned and operated by designated point source management agencies.
    3. If consolidation is not feasible, encourage privately owned wastewater treatment facilities to be operated and maintained by the appropriate designated point source management agency. In these particular situations do not allow a privately owned wastewater treatment facility to be expanded above current permitted levels.
    4. Require central sewer to be used whenever possible to provide an acceptable method of wastewater treatment and effluent disposal for projected residential, commercial, and industrial growth areas.
F. Proposals that SC DHEC considers controversial or otherwise needing special attention to include public participation.

For major amendments which entail a new wastewater treatment facility construction or expansion to an existing wastewater treatment facility, a Preliminary Engineering Report must be submitted as part of the Section 208 amendment proposal. The Preliminary Engineering Report should contain the following pertinent information:

A. Justification for the wastewater facility plan update or project including an explanation for the need of one or more of the following:
    1. Construction of a new wastewater treatment facility.
    2. A change in the service area, method of treated effluent disposal, treated effluent discharge point, or increase in design capacity of an existing wastewater treatment facility to meet revised 20 year needs.
    3. The execution of an interlocal agreement between two or more designated point source management agencies or local governments regarding sewer service areas, bulk treatment of wastewater, or joint use of an effluent outfall line.
B. Identification of the designated 20-year planning area, showing any joint jurisdictional areas, if applicable.
C. Projected land use patterns over the 20-year planning period for the designated wastewater facilities planning area.
D. Population projections for the designated planning area over a 20-year planning period and associated wastewater flow.
E. Evaluation of feasible wastewater collection, treatment and/or effluent disposal alternatives which would be required to handle the projected wastewater flow to meet 20-year needs for the planning area.
F. Environmental assessment and cost effectiveness analysis for the most feasible wastewater collection, treatment, and/or effluent disposal alternatives. The cost effectiveness analysis shall be based on present worth analysis of alternatives in accordance with generally accepted methodology, such as that described in:
    - EPA Guidelines (40 CFR 35, Subpart E, Appendix A, “Cost Effectiveness Guidelines”), or
    - Engineering economic reference texts
G. Identification of the selected wastewater collection, treatment, and/or effluent disposal alternatives identified in the above analysis.
H. If the above analysis determines that the existing wastewater treatment facility must be expanded, or that a new facility must be constructed to handle the projected 20-year design flow, the following items must be included in the Preliminary Engineering Report:
    - Process design criteria and typical process flow schematic for the selected treatment alternative.

- Expected effluent quality; wasteload allocation and proposed NPDES permit limits, issued by SC DHEC for the selected treatment alternative.
- For phased wastewater treatment facility upgrades, the phase schedule, design flow, process design, expected effluent quality, and method of treated effluent disposal for each phase.
- Comments from all jurisdictional agencies and interested parties.

I. The method of sludge disposal associated with the selected treatment alternative must be identified; offsite disposal may require the approval of the disposal site operator (responsible local government or applicable sewer district).

One of the primary purposes of the Section 208 amendment procedure is to allow for stakeholder input and public participation and comment on the proposed project. For **Minor Amendments,** a public notice shall be sent to all appropriate stakeholders and interested parties and be published in a local newspaper of general circulation. Public comments or a request for a public hearing on the proposed facility plan or project must be received within fifteen (15) days from the date of the public notice issuance.

For **Major Amendments,** a public meeting, advertised by a 30-day public notice in a local newspaper of general circulation, must be held to receive comments on the proposed facility plan or project. The meeting record shall remain open for ten (10) days following the public meeting date to receive written comments on the proposed amendment. A responsiveness summary shall then be drafted to address all comments received.

Following the public comment period, a resolution providing details of the proposed amendment is presented to the Waccamaw Regional COG Board of Directors for their review and final approval. Whenever possible, a recommendation from the Waccamaw Region Section 208 Executive Advisory Committee is provided to the Board of Directors to assist them with the approval decision. The final resolution authorizing the Section 208 Plan Amendment is then submitted to SC DHEC allowing the permitting process to move forward on the proposed project.

TOTAL MAXIMUM DAILY LOAD AND WASTELOAD ALLOCATION PROCEDURES

One of the primary strategies for managing waterbodies that are identified as impaired on the state's 303(d) list is to develop and implement a Total Maximum Daily Load for the pollutant of concern. The TMDL development process involves the determination of the maximum quantity of that particular pollutant that can enter the waterbody and still meet the water quality standards established for the waterbody. Both non-point and point sources of pollution are evaluated in the final TMDL determination. Modeling is used to account for the wasteload allocations and load allocations that are needed to reduce the pollutant levels necessary to meet the in-stream water quality standards. This mathematical model simulates the flow and waste assimilative characteristics of the stream to determine the maximum allowable loading. Wasteloads from point source dischargers are expressed and monitored as pounds per day (lbs/d) of Ultimate Oxygen Demand.

As part of the Memorandum of Agreement between SC DHEC and the Waccamaw Regional Council of Governments, the Section 208 Program Administrator shall help facilitate the wasteload allocation process as part of the TMDL development process. Initially SC DHEC runs simulation models using the maximum loading allowed by the appropriate EPA technologically based limits for domestic wastewater dischargers and effluent guidelines for industrial dischargers. The model output is used to determine if the waterbody is an Effluent Limited Stream Segment or a Water Quality Limited Stream Segment. A brief description of each type of classification is provided below.

Effluent Limited Stream Segment: If the model shows that each discharger can discharge its technology based allowed loadings without causing water quality violations and the antidegradation rules of SC Regulation 61-68, Water Classifications and Standards, are properly addressed, then each discharger is issued a permit with technology based effluent limitations.

Water Quality Limited Stream Segment: If the model indicates that water quality standard violations will occur despite the implementation of the proposed technology-based loadings, then the waterbody is classified as Water Quality Limited. Under this type of circumstance more stringent permit limits are required and appropriate loading allocations are established to ensure that total loadings of all discharges in the stream segment do not cause violations of the water quality standards or Antidegradation Rules.

TMDL wasteload allocation decisions are necessary under several circumstances including when there is a proposed new discharger, an expansion of an existing discharger, or a new model generates a revised maximum allowable loading for the impaired stream. The following principles are utilized during the TMDL wasteload allocation process:

1. The process should be reasonable and fair to all parties;
2. Preferably, existing and proposed dischargers should cooperatively decide how the total loading to the waterbody will be reduced and allocated among themselves. If the affected dischargers cannot agree on the appropriate allocations then SC DHEC shall make the final wasteload allocation decision.
3. In situations when SC DHEC determines the final wasteload allocation, the agency generally will reduce the loadings of the affected permit holders by the same percentage.
4. Once a loading has been divided between two or more dischargers, it is expected that most expansions will not require further division of the allowable loading. Increased flow will be allowed while holding the Ultimate Oxygen Demand poundage constant, thus requiring better treatment on the part of the expanding discharger. In instances where an expansion is of such magnitude that a serious inequity in treatment costs would result or the expanding discharger would be required to treat beyond the limits of technology, reallocation would be considered.
5. With respect to new dischargers, whenever possible, reductions in an existing discharger's permitted loadings will be made so that adverse impact to existing dischargers will be minimized. For example, any existing permits with excess Ultimate Oxygen Demand capacity will normally be reduced first so that whenever possible no actual costs are incurred by an existing discharger.
6. New or expanded dischargers will normally have reductions in their allowed technology based loadings at least equal to the largest percent reduction of any existing discharger.
7. Reductions in permitted loadings will be limited to the limits of treatment technology.
8. A permit for a new or expanded discharger will not be issued until after all the existing dischargers' permits that must be reduced to allow for the new or expanded discharger are issued and effective (with no appeals pending)
9. No permit issued by SCDHEC shall be interpreted as creating any vested right in any person.

The sections below explain the process SC DHEC uses to accomplish the reduction in the total permitted loading to a stream in the implementation of a TMDL. The process cannot possibly cover every situation that can occur. Peculiar circumstances will be reviewed by SC DHEC on a case-by-case basis using the basic principles listed above.

Single New or Expanding Discharger: The simplest water quality limited wasteload allocation determination is when there is only one discharger in a stream segment. In these situations, the single discharger's permitted loading must be equal to or less than the total maximum point source load that the model indicates can be discharged without causing a water quality violation. In this situation, there is no allocation process needed for the loading since there is only one discharger whose permit loading limits must be established so that compliance with the water quality standards can be maintained.

One or More Existing Dischargers with Either a Proposed New or Expanded Discharger: When there is more than one discharger in a stream segment, the situation is much more complicated since there must be an allocation of the allowed stream loading among the existing dischargers and any proposed dischargers. Depending on how this is accomplished, the proposed discharger and some or all of the existing dischargers will not be allowed to discharge the maximum loading allowed by their appropriate technology based limitations. Normally any existing discharger should not receive a larger percent reduction from its technology based limitations than a proposed discharger would receive.

- ***SC DHEC Issues-*** SC DHEC's primary concern in the wasteload allocation process is that water standards are maintained. This is accomplished by ensuring that the total loading of all dischargers in a stream segment does not cause water quality violations as predicted by the water quality model. As to how those necessary wasteload allocations are distributed to meet the water quality standards, SC DHEC prefers that the respective Council of Governments office facilitate a process that is agreeable to the affected point source dischargers.
- ***Selecting Dischargers for Reductions and the Water Quality Evaluation Process-*** If dischargers cannot agree on how the maximum allowed loading will be allocated among themselves, a simple way for SC DHEC to reallocate the allowed stream loading would be to lower each discharger's allowed technology based loadings by the same percentage until the model predicts that all water quality standards would be met. This may require some dischargers to spend money unnecessarily as other dischargers may be able to take the reduction without any adverse impact to their operation. SC DHEC must evaluate the situation to determine how the permitted loadings should be allocated in a manner that is reasonable and cost-effective.

  In the allocation process among dischargers, SC DHEC determines if any of the existing dischargers can reduce their present permit limitations without adversely affecting their operations. If all existing dischargers have technology based limits and none of them can take a reduction without adversely affecting their operations, SC DHEC will reduce all existing and proposed dischargers by the same percentage until the model predicts that all water quality standards are met.

  If SC DHEC determines that one or more dischargers can take a reduction without adverse impact on their operations then those dischargers are reduced first. For example, if an existing discharger is not discharging the maximum loading as given in its permit and the discharger's facility is operating at its maximum production or wastewater flow rate, then the discharger has excess capacity that may be available in the reallocation process. Further, if any existing discharger can take a reduction without incurring any substantial costs associated with meeting the reduced permit limit, then this discharger is also a candidate for a reduction. SC DHEC makes these evaluations by comparing a discharger's existing effluent data in its discharge monitoring report to its permit effluent limitations. Also, SC DHEC may make a judgment on whether a discharger can reduce its actual loading by improving operation and maintenance at its wastewater treatment plant or by using in-plant controls that are not costly. If these reductions are sufficient to allow the proposed new or expanded discharger at the same percent reduction, the selected permits are modified. When the selected discharge permits are modified with no appeals pending, the new or expanded discharger will be permitted.

  If the reductions for the selected dischargers are not sufficient to allow the new or expanded discharger and in situations where SC DHEC is not able to determine if there are any facilities that can take a reduction without adversely affecting their operations, SC DHEC will determine if any dischargers have permitted loadings that are already reduced below their technology based limitations. If there are dischargers with permit limits that are already lower than their maximum allowed technology based limits and there is at least one discharger with no reductions below its technology based limitations, SC DHEC will normally reduce the permit limitations of each discharger that has technology based effluent limitations by the same percentage and reevaluate the situation using the water quality model. This percent reduction evaluation is then repeated using only the selected dischargers until either the model predicts water quality standards will be maintained or the percent reduction used for determining the loading inputs to the model equals the percent reduction for a discharger with a permit which already has a reduction below technology based limits, whichever occurs first.

If the water quality model predicts that water quality standards will be maintained before the percent reduction equals the existing percent reduction that other dischargers have, the selected dischargers will have their permit loadings reduced by permit modification. If the model, using the loadings from the proposed percent reduction evaluation, shows that water quality standards are not being maintained and the percent reduction used in the evaluation reaches an existing non-selected discharger's actual percent reduction, that discharger is added to the selected dischargers that must further reduce their loadings and the model is run again. This process is repeated until the water quality model predicts water quality standards will be maintained.

In this reduction evaluation process, no discharger's permit loadings will be reduced below their limits of treatment technology as determined by SC DHEC. When a discharger's proposed permit reductions reach their limits of treatment technology, their permit loadings are not reduced any further in the reduction evaluation process. When the evaluation is completed, SC DHEC modifies the selected discharge permits. When the selected discharge permits are modified with no appeals pending, the new or expanded permit will be issued.

- ***Limits of Treatment Technology-*** In situations where one or more existing dischargers are at their limits of treatment technology, SC DHEC will reduce the permitted loadings of the dischargers that are not at the limits of treatment technology by the same percentage until the model predicts that all water quality standards will be met. The new or expanded discharger will have the same percent reduction from their technology based limits. In this evaluation when an existing discharger reaches their limits of treatment technology, their loading will not be reduced any further and the modeling will be repeated using further reductions for the dischargers that have not reached their limits of treatment technology. If the evaluation reaches a point where all existing and proposed dischargers' loadings have been reduced to their limits of treatment technology and the model still predicts that water quality violations will occur, the new or expanded discharger cannot be allowed as proposed. The new or expanded discharger may be allowed on a smaller scale than was originally proposed such that the total loading from all dischargers will meet water quality standards.

  In situations where SC DHEC determines that all existing dischargers are already reduced to their limits of treatment technology, the existing total loading to the stream cannot be reduced through better treatment. In this situation, the new or expanded discharger cannot be permitted to surface waters unless reductions are made in other ways. SC DHEC will normally encourage existing dischargers to reduce their loadings by other means such as source reduction, recycling, land application of effluent, water conservation, alternate manufacturing processes, consolidation of facilities through regional planning, etc. In situations where SC DHEC determines that the existing loading exceeds the allowed stream loading, SC DHEC may require the actual loading to the stream to be reduced by the existing dischargers utilizing the above methods even when there is not a proposed new or expanding discharger.

- ***New or Expanded Discharge Is Proposed Before the TMDL Is Established-*** When a TMDL has not been established for an impaired waterbody, a new or expanded discharge that contains the pollutant(s) which caused the 303(d) list impairment will not be allowed unless there is a plan in place that is acceptable to SC DHEC that addresses no net increase in the loading of the pollutant into the impaired water body from all dischargers. In this situation, the appropriate existing discharges to the impaired water body will have their permits modified to include the limits necessary to insure no net increase in loading of the pollutant of concern. These permits will also contain a reopener clause that says the permit may be modified to comply with the TMDL when it is established. Further, these permits must include appropriate schedules of compliance for the work that must be completed to meet the reduced loadings. Upon establishment of the TMDL, the permits will be modified, as necessary, to comply with the TMDL.

- ***New or Expanded Discharge Is Proposed After the TMDL Is Established-*** If there is a proposed new or expanding discharger, the portion of the wasteload allocation reserved for reasonable foreseeable growth will be used and/or the wasteload allocation portion of the TMDL must be reallocated among the existing and proposed discharges. The margin of safety must be maintained in this process. Therefore, in this situation, new final effluent

limits for each discharger may be established depending on whether or not the reserved wasteload allocation by itself is sufficient to allow the new point source load. Any reduced limits will be based upon the percent reduction necessary to allow the new or expanded discharge at the same percent reduction as the existing discharges such that the wasteload allocation portion of the TMDL is not exceeded. All affected permits will be modified to include their allocated portion of the wasteload allocation of the TMDL. These new final TMDL limits will go into effect when the new or expanding discharge occurs or on a date that SC DHEC determines to be appropriate based on the situation.

- ***New or Expanded Permit Issuance-*** When permit modifications are necessary to reallocate the maximum allowed stream loading so that the new or expanded discharger can be permitted, the new or expanded permit is not issued until the necessary permit modifications have been made with no outstanding appeals. Any reductions to an existing discharger's permit limitations will go into effect when the new or expanded discharge actually occurs.

Section 208 Program Steering Committee

The 2010-2011 update of the Waccamaw Region Section 208 Water Quality Management Plan allowed local stakeholders representing governmental, educational, private business, and non-profit entities, to discuss water quality issues that affect the region and their respective communities. This led to the development of several water quality goals and corresponding management strategies to pursue over the course of the next twenty years. The management strategies outlined address a wide range of issues including point source pollution, non-point source pollution, water quality monitoring, land use management and conservation, as well as economic implications associated with water quality.

Realizing that partnership building and resource coordination will be a necessary and ongoing task for the successful implementation of the Waccamaw Region Section 208 Water Quality Management Plan, the Waccamaw Regional COG intends to organize a steering committee to oversee the implementation of this plan. The steering committee would meet regularly to evaluate the status of the recommendations included in the Section 208 Plan and to assess opportunities to pursue projects and initiatives aimed towards improving the water quality throughout the region. The steering committee shall be initiated within six months of the final adoption of this plan and should be developed with the assistance of the Section 208 Program Executive Committee. The steering committee shall meet no less than twice yearly. Specific matters that the committee should focus on include but are not limited to the following:

- An update of new major projects and initiatives aimed at addressing water quality issues including:
  - The construction or upgrade of new wastewater treatment facilities
  - New or reissued state and federal permits related to water quality management including NPDES general permits, such as the Small Municipal Separate Storm Sewer permit, and the Discharges from the Application of Pesticides permit.
- An update on septic system management needs within the Waccamaw region.
- An update of research initiatives by the USGS, North Inlet- Winyah Bay NERR, Coastal Carolina University, SC DHEC and other relevant agencies that are generating useful scientific data about water resource issues within the Waccamaw region. The steering committee can also assist in developing partnerships that may be useful towards research efforts that are conducted in the future.
- An update on water quality public education and awareness initiatives that are being conducted in the Waccamaw region. Programs that are being conducted in one community could be applicable and beneficial to other communities within the Waccamaw region.

- An update on existing water quality monitoring resources and future needs. A regular review and discussion on recent studies or monitoring results, especially reports generated through SC DHEC's Ambient Surface Water Monitoring Program such as the biennial 303 (d) list of impaired waterbodies, should be conducted.
- Other water resources topics of interest and concern to the steering committee and that may be brought forward by the Section 208 Program Executive Committee.

It is anticipated that this steering committee will provide a forum for productive communication, information sharing, and partnership building amongst all of the stakeholders of the Waccamaw Region Section 208 Water Quality Management Planning program.

This Page Has Been Left Blank Intentionally

APPENDIX A- Text of Section 208, Clean Water Act

AREAWIDE WASTE TREATMENT MANAGEMENT SEC. 208.

(a) For the purpose of encouraging and facilitating the development and implementation of areawide waste treatment management plans—

(1) The Administrator, within ninety days after the date of enactment of this Act and after consultation with appropriate Federal, State, and local authorities, shall by regulation publish guidelines for the identification of those areas which, as a result of urban-industrial concentrations or other factors, have substantial water quality control problems.

(2) The Governor of each State, within sixty days after publication of the guidelines issued pursuant to paragraph (1) of this subsection, shall identify each area within the State which, as a result of urban-industrial concentrations or other factors, has substantial water quality control problems. Not later than one hundred and twenty days following such identification and after consultation with appropriate elected and other officials of local governments having jurisdiction in such areas, the Governor shall designate (A) the boundaries of each such area, and (B) a single representative organization, including elected officials from local governments or their designees, capable of developing effective areawide waste treatment management plans for such an area. The Governor may in the same manner at any later time identify any additional area (or modify an existing area) for which he determines areawide waste treatment management to be appropriate, designate the boundaries of such area, and designate an organization capable of developing effective areawide waste treatment management plans for such area.

(3) With respect to any area which, pursuant to the guidelines published under paragraph (1) of this subsection, is located in two or more States, the Governors of the respective States shall consult and cooperate in carrying out the provisions of paragraph (2), with a view toward designating the boundaries of the interstate area having common water quality control problems and for which areawide waste treatment management plans would be most effective, and toward designating, within one hundred and eighty days after publication of guidelines issued pursuant to paragraph (1) of this subsection, of a single representative organization capable of developing effective areawide waste treatment management plans for such area.

(4) If a Governor does not act, either by designating or determining not to make a designation under paragraph (2) of this subsection, within the time required by such paragraph, or if, in the case of an interstate area, the Governors of the States involved do not designate a planning organization within the time required by paragraph (3) of this subsection, the chief elected officials of local governments within an area may by agreement designate (A) the boundaries for such an area, and (B) a single representative organization including elected officials from such local governments, or their designees, capable of developing an areawide waste treatment management plan for such area.

(5) Existing regional agencies may be designated under paragraphs (2), (3), and (4) of this subsection.

(6) The State shall act as a planning agency for all portions of such State which are not designated under paragraphs (2), (3), or (4) of this subsection.

(7) Designations under this subsection shall be subject to the approval of the Administrator.

(b)(1)(A) Not later than one year after the date of designation of any organization under subsection (a) of this section such organization shall have in operation a continuing areawide waste treatment management planning process consistent with section 201 of this Act. Plans prepared in accordance with this process shall contain alternatives for waste treatment management, and be applicable to all wastes generated within the area involved. The initial plan prepared in accordance with such process shall be certified by the Governor and submitted to the Administrator not later than two years after the planning process is in operation.

(B) For any agency designated after 1975 under subsection (a) of this section and for all portions of a State for which the State is required to act as the planning agency in accordance with subsection (a)(6), the initial plan prepared in accordance with such process shall be certified by the Governor and submitted to the Administrator not later than three years after the receipt of the initial grant award authorized under subsection (f) of this section.

(2) Any plan prepared under such process shall include, but not be limited to—

(A) the identification of treatment works necessary to meet the anticipated municipal and industrial waste treatment needs of the area over a twenty-year period, annually updated (including an analysis of alternative waste treatment systems), including any requirements for the acquisition of land for treatment purposes; the necessary waste water collection and urban storm water runoff systems; and a program to provide the necessary financial arrangements for the development of such treatment works, and an identification of open space and recreation opportunities that can be expected to result from improved water quality, including consideration of potential use of lands associated with treatment works and increased access to water-based recreation;

(B) the establishment of construction priorities for such treatment works and time schedules for the initiation and completion of all treatment works;

(C) the establishment of a regulatory program to—

(i) implement the waste treatment management requirements of section 201(c),

(ii) regulate the location, modification, and construction of any facilities within such area which may result in any discharge in such area, and

(iii) assure that any industrial or commercial waste discharged into any treatment works in such area meet applicable pretreatment requirements;

(D) the identification of those agencies necessary to construct, operate, and maintain all facilities required by the plan and otherwise to carry out the plan;

(E) the identification of the measures necessary to carry out the plan (including financing), the period of time necessary to carry out the plan, the costs of carrying out the plan within such time, and the economic, social, and environmental impact of carrying out the plan within such time;

(F) a process to (i) identify, if appropriate, agriculturally and silviculturally related nonpoint sources of pollution, including return flows from irrigated agriculture, and their cumulative effects, runoff from manure disposal areas, and from land used for livestock and crop production, and (ii) set forth procedures and methods (including land use requirements) to control to the extent feasible such sources;

(G) a process of (i) identify, if appropriate, mine-related sources of pollution including new, current, and abandoned surface and underground mine runoff, and (ii) set forth procedures and methods (including land use requirements) to control to the extent feasible such sources;

(H) a process to (i) identify construction activity related sources of pollution, and (ii) set forth procedures and methods (including land use requirements) to control to the extent feasible such sources;

(I) a process to (i) identify, if appropriate, salt water intrusion into rivers, lakes, and estuaries resulting from reduction of fresh water flow from any cause, including irrigation, obstruction, ground water extraction, and diversion, and (ii) set forth procedures and methods to control such intrusion to the extent feasible where such procedures and methods are otherwise a part of the waste treatment management plan;

(J) a process to control the disposition of all residual waste generated in such area which could affect water quality; and

(K) a process to control the disposal of pollutants on land or in subsurface excavations within such area to protect ground and surface water quality.

(3) Areawide waste treatment management plans shall be certified annually by the Governor or his designee (or Governors or their designees, where more than one State is involved) as being consistent with applicable basin plans and such areawide waste treatment management plans shall be submitted to the Administrator for his approval.

(4)(A) Whenever the Governor of any State determines (and notifies the Administrator) that consistency with a statewide regulatory program under section 303 so requires, the requirements of clauses (F) through (K) of paragraph (2) of this subsection shall be developed and submitted by the Governor to the Administrator for approval for application to a class or category of activity throughout such State.

(B) Any program submitted under subparagraph (A) of this paragraph which, in whole or in part, is to control the discharge or other placement of dredged or fill material into the navigable waters shall include the following:

(i) A consultation process which includes the State agency with primary jurisdiction over fish and wildlife resources.

(ii) A process to identify and manage the discharge or other placement of dredged or fill material which adversely affects navigable waters, which shall complement and be coordinated with a State program under section 404 conducted pursuant to this Act.

(iii) A process to assure that any activity conducted pursuant to a best management practice will comply with the guidelines established under section 404(b)(1), and sections 307 and 403 of this Act.

(iv) A process to assure that any activity conducted pursuant to a best management practice can be terminated or modified for cause including, but not limited to, the following:

(I) violation of any condition of the best management practice;

(II) change in any activity that requires either a temporary or permanent reduction or elimination of the discharge pursuant to the best management practice.

(v) A process to assure continued coordination with Federal and Federal-State water-related planning and reviewing processes, including the National Wetlands Inventory.

(C) If the Governor of a State obtains approval from the Administrator of a statewide regulatory program which meets the requirements of subparagraph (B) of this paragraph and if such State is administering a permit program under section 404 of this Act,

no person shall be required to obtain an individual permit pursuant to such section, or to comply with a general permit issued pursuant to such section, with respect to any appropriate activity within such State for which a best management practice has been approved by the Administrator under the program approved by the Administrator pursuant to this paragraph.

(D)(i) Whenever the Administrator determines after public hearing that a State is not administering a program approved under this section in accordance with the requirements of this section, the Administrator shall so notify the State, and if appropriate corrective action is not taken within a reasonable time, not to exceed ninety days, the Administrator shall withdraw approval of such program. The Administrator shall not withdraw approval of any such program unless he shall first have notified the State, and made public, in writing, the reasons for such withdrawal.

(ii) In the case of a State with a program submitted and approved under this paragraph, the Administrator shall withdraw approval of such program under this subparagraph only for a substantial failure of the State to administer its program in accordance with the requirements of this paragraph.

(c)(1) The Governor of each State, in consultation with the planning agency designated under subsection (a) of this section, at the time a plan is submitted to the Administrator, shall designate one or more waste treatment management agencies (which may be an existing or newly created local, regional or State agency or potential subdivision) for each area designated under subsection (a) of this section and submit such designations to the Administrator.

(2) The Administrator shall accept any such designation, unless, within 120 days of such designation, he finds that the designated management agency (or agencies) does not have adequate authority—

(A) to carry out appropriate portions of an areawide waste treatment management plan developed under subsection (b) of this section;

(B) to manage effectively waste treatment works and related facilities serving such area in conformance with any plan required by subsection (b) of this section;

(C) directly or by contract, to design and construct new works, and to operate and maintain new and existing works as required by any plan developed pursuant to subsection (b) of this section;

(D) to accept and utilize grants, or other funds from any source, for waste treatment management purposes;

(E) to raise revenues, including the assessment of waste treatment charges;

(F) to incur short- and long-term indebtedness;

(G) to assure in implementation of an areawide waste treatment management plan that each participating community pays its proportionate share of treatment costs;

(H) to refuse to receive any wastes from any municipality or subdivision thereof, which does not comply with any provisions of an approved plan under this section applicable to such area; and

(I) to accept for treatment industrial wastes.

(d) After a waste treatment management agency having the authority required by subsection (c) has been designated under such subsection for an area and a plan for such area has been approved under subsection (b) of this section, the Administrator shall not make any grant for construction of a publicy owned treatment works under section 201(g)(1) within such area except to such designated agency and for works in conformity with such plan.

(e) No permit under section 402 of this Act shall be issued for any point source which is in conflict with a plan approved pursuant to subsection (b) of this section.

(f)(1) The Administrator shall make grants to any agency designated under subsection (a) of this section for payment of the reasonable costs of developing and operating a continuing areawide waste treatment management planning process under subsection (b) of this section.

(2) For the two-year period beginning on the date of the first grant is made under paragraph (1) of this subsection to an agency, if such first grant is made before October 1, 1977, the amount of each such grant to such agency shall be 100 per centum of the costs of developing and operating a continuing areawide waste treatment management planning process under subsection (b) of this section, and thereafter the amount granted to such agency shall not exceed 75 per centum of such costs in each succeeding one-year period. In the case of any other grant made to an agency under such paragraph (1) of this subsection, the amount of such grant shall not exceed 75 per centum of the costs of developing and operating a continuing areawide waste treatment management planning process in any year.

(3) Each applicant for a grant under this subsection shall submit to the Administrator for his approval each proposal for which a grant is applied for under this subsection. The Administrator shall act upon such proposal as soon as practicable after it has been submitted, and his approval of that proposal shall be deemed a contractual obligation of the United States for the payment of its contribution to such proposal, subject to such amounts as are provided in appropriation Acts. There is authorized to be appropriated to carry out this subsection not to exceed $50,000,000 for the fiscal year ending June 30, 1973, not to exceed $100,000,000 for the fiscal year ending June 30, 1974, not to exceed $150,000,000 per fiscal year for the fiscal years ending June 30, 1975, September 30, 1977,

September 30, 1978, September 30, 1979, and September 30, 1980, not to exceed $100,000,000 per fiscal year for the fiscal years ending September 30, 1981, and September 30, 1982, and such sums as may be necessary for fiscal years 1983 through 1990.

(g) The Administrator is authorized, upon request of the Governor or the designated planning agency, and without reimbursement, to consult with, and provide technical assistance to, any agency designated under subsection (a) of this section in the development of areawide waste treatment management plans under subsection (b) of this section.

(h)(1) The Secretary of the Army, acting through the Chief of Engineers, in cooperation with the Administrator is authorized and directed, upon request of the Governor or the designated planning organization, to consult with, and provide technical assistance to, any agency designed 1 under subsection (a) of this section in developing and operating a continuing areawide waste treatment management planning process under subsection (b) of this section.

(2) There is authorized to be appropriated to the Secretary of the Army, to carry out this subsection, not to exceed $50,000,000 per fiscal year for the fiscal years ending June 30, 1973, and June 30, 1974.

(i)(1) The Secretary of the Interior, acting through the Director of the United States Fish and Wildlife Service, shall, upon request of the Governor of a State, and without reimbursement, provide technical assistance to such State in developing a statewide program for submission to the Administrator under subsection (b)(4)(B) of this section and in implementing such program after its approval.

(2) There is authorized to be appropriated to the Secretary of the Interior $6,000,000 to complete the National Wetlands Inventory of the United States, by December 31, 1981, and to provide information from such Inventory to States as it becomes available to assist such States in the development and operation of programs under this Act.

(j)(1) The Secretary of Agriculture, with the concurrence of the Administrator, and acting through the Soil Conservation Service and such other agencies of the Department of Agriculture as the Secretary may designate, is authorized and directed to establish and administer a program to enter into contracts, subject to such amounts as are provided in advance by appropriation acts, of not less than five years nor more than ten years with owners and operators having control of rural land for the purpose of installing and maintaining measures incorporating best management practices to control nonpoint source pollution for improved water quality in those States or areas for which the Administrator has approved a plan under subsection (b) of this section where the practices to which the contracts apply are certified by the management agency designated under subsection (c)(1) of this section to be consistent with such plans and will result in improved water quality. Such contracts may be entered into during the period ending not later than September 31, 1988. Under such contracts the land owners or operator shall agree—

(i) to effectuate a plan approved by a soil conservation district, where one exists, under this section for his farm, ranch, or other land substantially in accordance with the schedule outlined therein unless any requirement thereof is waived or modified by the Secretary;

(ii) to forfeit all rights to further payments or grants under the contract and refund to the United States all payments and grants received thereunder, with interest, upon his violation of the contract at any stage during the time he has control of the land if the Secretary, after considering the recommendations of the soil conservation district, where one exists, and the Administrator, determines that such violation is of such a nature as to warrant termination of the contract, or to make refunds or accept such payment adjustments as the Secretary may deem appropriate if he determines that the violation by the owner or operator does not warrant termination of the contract;

(iii) upon transfer of his right and interest in the farm, ranch, or other land during the contract period to forfeit all rights to further payments or grants under the contract and refund to the United States all payments or grants received thereunder, with interest, unless the transferee of any such land agrees with the Secretary to assume all obligations of the contract;

(iv) not to adopt any practice specified by the Secretary on the advice of the Administrator in the contract as a practice which would tend to defeat the purposes of the contract;

(v) to such additional provisions as the Secretary determines are desirable and includes in the contract to effectuate the purposes of the program or to facilitate the practical administration of the program.

(2) In return for such agreement by the landowner or operator the Secretary shall agree to provide technical assistance and share the cost of carrying out those conservation practices and measures set forth in the contract for which he determines that cost sharing is appropriate and in the public interest and which are approved for cost sharing by the agency designated to implement the plan developed under subsection (b) of this section. The portion of such cost (including labor) to be shared shall be that part which the Secretary determines is necessary and appropriate to effectuate the installation of the water quality management practices and measures under the contract, but not to exceed 50 per centum of the total cost of the measures set forth in the contract; except the Secretary may increase the matching cost share where he determines that (1) the main benefits to be derived from the measures are related to improving offsite water quality, and (2) the matching share requirement would place a burden on the landowner which would probably prevent him from participating in the program.

(3) The Secretary may terminate any contract with a landowner or operator by mutual agreement with the owner or operator if the Secretary determines that such termination would be in the public interest, and may agree to such modification of contracts

previously entered into as he may determine to be desirable to carry out the purposes of the program or facilitate the practical administration thereof or to accomplish equitable treatment with respect to other conservation, land use, or water quality programs.

(4) In providing assistance under this subsection the Secretary will give priority to those areas and sources that have the most significant effect upon water quality. Additional investigations or plans may be made, where necessary, to supplement approved water quality management plans, in order to determine priorities.

(5) The Secretary shall, where practicable, enter into agreements with soil conservation districts, State soil and water conservation agencies, or State water quality agencies to administer all or part of the program established in this subsection under regulations developed by the Secretary. Such agreements shall provide for the submission of such reports as the Secretary deems necessary, and for payment by the United States of such portion of the costs incurred in the administration of the program as the Secretary may deem appropriate.

(6) The contracts under this subsection shall be entered into only in areas where the management agency designated under subsection (c)(1) of this section assures an adequate level of participation by owners and operators having control of rural land in such areas. Within such areas the local soil conservation district, where one exists, together with the Secretary of Agriculture, will determine the priority of assistance among individual land owners and
operators to assure that the most critical water quality problems are addressed.

(7) The Secretary, in consultation with the Administrator and subject to section 304(k) of this Act, shall, not later than September 30, 1978, promulgate regulations for carrying out this subsection and for support and cooperation with other Federal and non-Federal agencies for implementation of this subsection.

(8) This program shall not be used to authorize or finance projects that would otherwise be eligible for assistance under the terms of Public Law 83–566.

(9) There are hereby authorized to be appropriated to the Secretary of Agriculture $200,000,000 for fiscal year 1979, $400,000,000 for fiscal year 1980, $100,000,000 for fiscal year 1981, $100,000,000 for fiscal year 1982, and such sums as may be necessary for fiscal years 1983 through 1990, to carry out this subsection. The program authorized under this subsection shall be in addition to, and not in substitution of, other programs in such area authorized by this or any other public law. (33 U.S.C. 1288)

APPENDIX B- Water Classifications and Site Specific Standards

Table B-1- Waterbody Classifications and Descriptions in the Waccamaw Region			
Waterbody Name	**County(ies)**	**Classification**	**Water Body Description and Applicable Site Specific Standards**
Bartons Branch (Summerhouse Branch and Johnsons Swamp)	Williamsburg, Georgetown	FW	The entire stream tributary to Black River (DO not less than 4.0 mg/L, pH 5.0-8.5)
Bass Hole Bay	Georgetown	ORW	The entire bay between Old Man Creek and Debidue Creek
Black River	Lee, Williamsburg	FW	From the headwaters to US 701 (DO not less than 4.0 mg/L, pH 5.0-8.5
Black River	Lee, Sumter, Clarendon, Williamsburg, Georgetown	SA	From US 701 to Winyah Bay
Bly Creek	Georgetown	ORW	The entire creek tributary to Old Man Creek
Bob's Garden Creek	Georgetown	ORW	The entire creek tributary to Jones Creek
Boor Creek	Georgetown	ORW	The entire creek between Jones Creek and Wood Creek
Bread and Butter Creek	Georgetown	ORW	The entire creek tributary to Town Creek
Brown Swamp	Horry	FW	The entire stream tributary to Little Pee Dee River (DO not less than 4.0 mg/L, pH 5.0-8.5
Bull Creek	Horry	FW	Pee Dee River to Waccamaw River
Chinners Swamp	Horry	FW	The entire stream tributary to Brunson Swamp (DO mg/L not less than 4.0, pH 5.0-8.5)
Clambank Creek	Georgetown	ORW	The entire creek tributary to Town Creek
Clark Creek	Williamsburg, Florence	FW	The entire stream tributary to Pee Dee River (DO not less than 4.0mg/L, pH 5.0-8.5)
Coastal Water	Georgetown, Horry	SFH	From the land to the limits of State jurisdiction
Cooks Creek	Georgetown	ORW	The entire creek between Old Man Creek and Debidue Creek
Crabhaul Creek	Georgetown	ORW	The entire creek tributary to Old Man Creek
Cutoff Creek	Georgetown	SFH	The entire creek between Oyster Bay and Town Creek
Debidue Creek	Georgetown	SFH	That portion of the creek from headwaters to confluence with Cooks Creek but not including tidal creeks on western shore between Bass Hole Bay and Cooks Creek
Debidue Creek	Georgetown	ORW	That portion of the creek from confluence with Cooks Creek to North inlet andall tidal creeks including those on western shore between Bass Hole Bay and Cooks Creek
Debordieu Channel	Georgetown	SFH	The entire channel to Debidue Creek
Duck Creek	Georgetown	ORW	The entire creek tributary to Jones Creek
Dunn Sound	Horry	SFH	The entire sound
Ground Waters	Statewide	GB	The entire groundwaters of the state, unless otherwise listed
Haulover Creek	Georgetown	SB	The entire creek between Mud Bay and Jones Creek
Hog Inlet/ Cherrry Grove Inlet	Horry	SFH	The entire inlet
Hunting Swamp	Horry	FW	The entire stream tributary to Little Pee Dee River
Intracoastal Waterway	Horry	SA	From the North Carolina border to SC Highway 9
Intracoastal Waterway	Horry	FW	From SC Highway 9 to confluence with Waccamaw River
Source: *South Carolina Department of Health and Environmental Control, R.61-69 Classified Waters*			

Table B-1- Waterbody Classifications and Descriptions in the Waccamaw Region- Continued			
Waterbody Name	**County(ies)**	**Classification**	**Water Body Description and Applicable Site Specific Standards**
Intracoastal Waterway	Georgetown	SA	From Winyah Bay to South Santee River
Intracoastal Waterway	Horry, Georgetown	FW	From confluence with Waccamaw River to Thoroughfare Creek (DO not less than 4.0 mg/L, pH 5.0-8.5)
Intracoastal Waterway	Georgetown	SA	From Thoroughfare Creek to Winyah Bay (DO not less than 4.0 mg/L)
Johnsons Swamp (Summerhouse Branch and Bartons Branch)	Williamsburg, Georgetown	FW	The entire stream tributary to Black River
Jones Creek	Georgetown	SB	That portion of the creek from its confluence with Mud Bay to its confluence with Nancy Creek
Jones Creek	Georgetown	SFH	That portion of the creek from its confluence with Nancy Creek to a point midway between its confluence with Dick Creek and Noble Slough
Jones Creek	Georgetown	ORW	That portion of the creek from a point midway between its confluene with Duck Creek and Noble Slough to North Inlet
Lake Swamp	Horry	FW	The entire stream tributary to Little Pee Dee River (DO not less than 4.0 mg/L, pH 5.0-8.5
Lake Swamp (Lake City, also called Lynches Lake)	Florence, Williamsburg	FW	The entire lake (DO not less than 4.0mg/L, pH 5.0-8.5)
Little Jones Creek	Georgetown	SFH	The entire creek tributary to Jones Creek
Little Pee Dee River	Marion, Horry	ORW	That portion from the confluence with Lumber River to the confluence with the Great Pee Dee River
Little River Inlet	Horry	SFH	The entire inlet from the confluence with the Atlantic Ocean to its confluence with the Intracoastal Waterway
Lumber River	Marion, Dillon, Horry	FW	The entire stream tributary to the Little Pee Dee River
Mud Creek	Georgetown	SFH	The entire creek between Oyster Bay and Town Creek
Muddy Creek	Williamsburg, Florence	FW	The entire stream tributary to Clarks Creek (DO not less than 4.0 mg/L, pH 5.0-8.5)
Murrells Inlet	Georgetown	SFH	The entire inlet tributary to Atlantic Ocean
Nancy Creek	Georgetown	SB	The entire tributary to Jones Creek
No Mans Friend Creek	Georgetown	SB	The entire creek between Mud Bay and Oyster Bay
Noble Slough	Georgetown	SB	The entire creek between Oyster Bay and Jones Creek
North Inlet	Georgetown	ORW	The entire inlet tributary to Atlantic Ocean
North Santee River	Georgetown	FW	That fresh water portion of the stream
North Santee River	Georgetown	SA	From US 17 to 1000 feet below the Intracoastal Waterway
North Santee River	Georgetown	ORW	From 1000 feet below the Intracoastal Waterway to the Atlantic Ocean
Old Man Creek	Georgetown	ORW	The entire creek tributary to Town Creek
Oyster Bay	Georgetown	SB	The entire bay between No Mans Friend Creek and Noble Slough
Palmetto Swamp	Horry	FW	The entire stream tributary to Little Pee Dee River
Pee Dee River	Chesterfield, Dillon, Marlboro, Darlington, Florence, Marion, Williamsburg	FW	From North Carolina state line to confluence with Thoroughfare Creek
Pee Dee River	Georgetown	SB	From its confluence with Thoroughfare Creek to Winyah Bay (DO not less than 5.0mg/L daily average, minimum 4.0mg/L
Source: *South Carolina Department of Health and Environmental Control, R.61-69 Classified Waters*			

Table B-1- Waterbody Classifications and Descriptions in the Waccamaw Region- Continued			
Waterbody Name	**County(ies)**	**Classification**	**Water Body Description and Applicable Site Specific Standards**
Pleasant Meadow Swamp	Horry	FW	The entire stream tributary to Lake Swamp (DO not less than 4.0mg/L, pH 5.0-8.5)
Pudding Swamp	Clarendon, Sumter, Williamsburg	FW	The entire swamp tributary to the Black River (DO not less than 4.0, pH 5.0-8.5)
Sampit River	Georgetown	FW	From the headwaters to salt water intrusion (DO not less than 4.0 mg/L, pH 5.0-8.5)
Sampit River	Georgetown	SB	From salt water intrusion to Winyah Bay
Santee River	Clarendon, Berkeley, Williamsburg, Georgetown	FW	That portion of the stream below Lake Marion to the North and South Santee Rivers
Schewbough Branch, also called Skeebo Branch	Horry	FW	The entire stream tributary to the North Carolina stateline (DO not less than 4.0mg/L, pH 5.0-8.5)
Sea Creek Bay	Georgetown	ORW	The entire bay tributary to Old Man Creek
Sixty Bass Creek	Georgetown	SFH	That portion of the creek from its confluence with Town Crek to a point 0.4 mil from its confluence with Town Creek
Sixty Bass Creek	Georgetown	ORW	That portion of the creek from a point 0.4 mil from its confluence with Town Creek to North Inlet
South Santee River	Berkeley, Charleston, Georgetown	FW	That freshwater portion
South Santee River	Berkeley, Charleston, Georgetown	SA	From US 17 to 1000 feet below the Intracoastal Waterway
South Santee River	Berkeley, Charleston, Georgetown	ORW	From 1000 feet below the Intracoastal Waterway to the Atlantic Ocean
Town Creek	Georgetown	SB	That portion of the creek from its confluence with No Mans Friend Creek and Oyster Bay to its western confluence with Clambank Creek
Town Creek	Georgetown	SFH	That portion of the creek from its western confluence with Clambank Creek to its eastern confluence with Clambank Creek
Town Creek	Georgetown	ORW	That portion of the creek from its eastern confluence with Clambank Creek to North Inlet
Waccamaw River	Horry, Georgetown	FW	From North Carolina stateline to its confluence with Thoroughfare Creek (DO not less than 4.0 mg/L, pH 5.0-8.5)
Waccamaw River	Georgetown	SA	From its confluence with Thoroughfare Creek to Winyah Bay (DO not less than 4.0mg/L)
Winyah Bay	Georgetown	SB	The entire bay tributary to Atlantic Ocean
Source: *South Carolina Department of Health and Environmental Control, R.61-69 Classified Waters*			

Table B-2: South Carolina Water Classifications and Standards

Water Classification	Description	Standards
Outstanding National Resource Waters (ONRW)	Freshwaters or saltwaters that constitute an outstanding national recreational or ecological resource.	A. Discharge from domestic, industrial, or agricultural waste treatment facilities; aquaculture; open water dredged spoil disposal- *NONE ALLOWED* B. Stormwater and other nonpoint source runoff, including that from agricultural uses, or permitted discharge from aquatic farms, concentrated aquatic animal production facilities, and uncontaminated groundwater from mining- *NONE ALLOWED* C. Dumping or disposal of garbage, cinders, ashes, oils, sludge, or other refuse- *NONE ALLOWED* D. Activities or dischargers from waste treatment facilities in waters upstream or tributary to ONRW waters- *Allowed if there will be no measurable impact on the downstream ONRW consistent with Antidegradation Rules.*
Outstanding Resource Waters (ORW)	Freshwaters or saltwaters which constitute an outstanding recreational or ecological resource or those freshwaters suitable as a source for drinking water supply purposes with treatment levels specified by SC DHEC.	A. Discharge from domestic, industrial, or agricultural waste treatment facilities; aquaculture; open water dredged spoil disposal- *NONE ALLOWED* B. Stormwater and other nonpoint source runoff, including that from agricultural uses, or permitted discharge from aquatic farms, concentrated aquatic animal production facilities, and uncontaminated groundwater from mining- *Allowed if water quality necessary for existing and classified uses shall be maintained and protected consistent with Antidegradation Rules.* C. Dumping or disposal of garbage, cinders, ashes, oils, sludge, or other refuse- *NONE ALLOWED* D. Activities or discharges from waste treatment facilities in waters upstream or tributary to ORW waters- *Allowed if water quality necessary for existing and classified uses shall be maintained and protected consistent with Antidegradation Rules.*
Trout Waters	The State recognizes three types of Trout Waters: Natural (TN), Put, Grow, and Take (TPGT), and Put and Take (TPT). There are no waterbodies located within the Waccamaw Region that are classified as Trout Waters.	
Freshwaters (FW)	Freshwaters suitable for primary and secondary contact recreation and as a source for drinking water supply after conventional treatment in accordance with the requirements of SC DHEC. Suitable for fishing and the survival and propagation of a balanced indigenous aquatic community of fauna and flora. Suitable also for industrial and agricultural uses.	A. Garbage, cinders, ashes, oils, sludge or other refuse- *NONE ALLOWED.* B. Treated wastes toxic wastes, deleterious substances, colored or other wastes except those given in (a) above- *None alone or in combination with other substances or wastes in sufficient amounts to make the waters unsafe or unsuitable for primary contact recreation or to impair the waters for any other best usage as determined for the specific waters which are assigned to this class.* C. Toxic Pollutants- Complete list is provided in the appendix of R.61-68. (http://www.scdhec.gov/environment/water/regs/r61-68.pdf) D. Dissolved Oxygen- *Daily average not less than 5.0 mg/l with a low of 4.0 mg/l* E. Fecal Coliform- *Not to exceed a geometric mean of 200/100ml, based on five consecutive samples during any 30 day period; nor shall more than 10% of the total samples during any 30 day period exceed 400/100ml.* F. pH- *Between 6.0 and 8.5* G. Temperature- See Section E.12 of R.61-68. (http://www.scdhec.gov/environment/water/regs/r61-68.pdf) H. Turbidity- *Not to exceed 25 NTUs in lakes provided existing uses are maintained. Not to exceed 50 NTUs in other waterbodies, provided existing uses are maintained.*

Source: *SC DHEC, 2008 R.61-68, Water Classifications and Standards*

Table B2 Continued: South Carolina Water Classifications and Standards

Water Classification	Description	Standards
Shellfish Harvesting Waters (SFH)	Tidal saltwaters protected for shellfish harvesting and uses listed in Class SA and Class SB. Suitable for primary and secondary contact recreation, crabbing, and fishing. Also suitable for the survival and propagation of a balanced indigenous aquatic community of marine fauna and flora.	A. Garbage, cinders, ashes, oils, sludge or other refuse- *NONE ALLOWED* B. Treated wastes toxic wastes, deleterious substances, colored or other wastes except those given in (a) above- *None alone or in combination with other substances or wastes in sufficient amounts to adversely affect the taste, color, odor or sanitary condition of clams, mussels, or oysters for human consumption; or to impair the waters for any other best usage as determined for the specific waters which are assigned to this class.* C. Toxic Pollutants- Complete list is provided in the appendix of R.61-68. (http://www.scdhec.gov/environment/water/regs/r61-68.pdf) D. Dissolved Oxygen- *Daily average not less than 5.0 mg/l with a low of 4.0 mg/l* E. Fecal Coliform- *Not to exceed an MPN fecal coliform geometric mean of 14/100 ml; nor shall more than 10% of the samples exceed an MPN of 43/100 ml.* F. Enterococci- *Not to exceed a geometric mean of 35/100 ml based on a least four sample collected from a given sampling site over a 30 day period; nor shall more than 10% of the samples exceed a single sample maximum of 104/100 ml during any 30 day period. Additionally, for beach monitoring and notification activities for Clean Water Act Section 406 only, samples shall not exceed a single sample maximum of 104/100 ml.* G. pH- *Shall not vary more than 3/10 of a pH unit above or below that of effluent free waters in the same geological area having a similar total salinity, alkalinity and temperature, but not lower than 6.5 or above 8.5* H. Temperature- See Section E.12 of R.61-68. (http://www.scdhec.gov/environment/water/regs/r61-68.pdf) I. Turbidity- *Not to exceed 25 NTUs provided existing uses are maintained.*
Class SA (SA)	Tidal saltwaters suitable for primary and secondary recreation, crabbing, and fishing, except harvesting of clams, mussels, or oysters for market purposes or human consumption and uses listed in Class SB. Also suitable for the survival and propagation of a balanced indigenous aquatic community of marina fauna and flora.	A. Garbage, cinders, ashes, oils, sludge or other refuse- *NONE ALLOWED* B. Treated wastes toxic wastes, deleterious substances, colored or other wastes except those given in (a) above- *None alone in combination with other substances or wastes in sufficient amounts to make the waters unsafe or unsuitable for primary contact recreation or to impair the waters for any other best usage as determined for the specific waters which are assigned to this class.* C. Toxic Pollutants- Complete list is provided in the appendix of R.61-68. (http://www.scdhec.gov/environment/water/regs/r61-68.pdf) D. Dissolved Oxygen- *Daily average not less than 5.0 mg/l with a low of 4.0 mg/l* E. Fecal Coliform- *Not to exceed a geometric mean of 200/100ml, based on five consecutive samples during any 30 day period; nor shall more than 10% of the total samples during any 30 day period exceed 400/100ml.* F. Enterococci- *Not to exceed a geometric mean of 35/100 ml based on a least four sample collected from a given sampling site over a 30 day period; nor shall more than 10% of the samples exceed a single sample maximum of 104/100 ml during any 30 day period. Additionally, for beach monitoring and notification activities for Clean Water Act Section 406 only, samples shall not exceed a single sample maximum of 104/100 ml.* G. pH- *Shall not vary more than one-half of a pH unit above or below that of effluent-free waters in the same geological area having a similar total salinity, alkalinity and temperature, but not lower than 6.5 or above 8.5.* H. Temperature- See Section E.12 of R.61-68. (http://www.scdhec.gov/environment/water/regs/r61-68.pdf) I. Turbidity- *Not to exceed 25 NTUs provided existing uses are maintained.*
Class SB (SB)	Tidal saltwaters suitable for primary and secondary contact recreation, crabbing, and fishing, except harvesting of clams, mussels, or oysters for market purposes or human consumption. Also suitable for the survival and propogation of a balanced indigenous aquatic community of marine fauna and flora.	A. Garbage, cinders, ashes, oils, sludge or other refuse- *NONE ALLOWED.* B. Treated wastes toxic wastes, deleterious substances, colored or other wastes except those given in (a) above- *None alone or in combination with other substances or wastes in sufficient amounts to be harmful to the survival of marine fauna and flora or the culture or propagation thereof; to adversely affect the taste, color, odor, or sanitary condition of fish for human consumption; to make the waters unsafe or unsuitable for primary contact recreation; or to impair the waters for any other best usage as determined for the specific waters which are assigned to this class.* C. Toxic Pollutants- Complete list is provided in the appendix of R.61-68. (http://www.scdhec.gov/environment/water/regs/r61-68.pdf) D. Dissolved Oxygen- *Not less than 4.0 mg/l* E. Fecal Coliform- *Not to exceed a geometric mean of 200/100ml, based on five consecutive samples during any 30 day period; nor shall more than 10% of the total samples during any 30 day period exceed 400/100ml.* F. Enterococci- *Not to exceed a geometric mean of 35/100ml based on at least four samples collected from a given sampling site over a 30 day period; nor shall more than 10% of the samples exceed a single sample maximum of 501/100 ml during any 30 day period. Additionally, for beach monitoring and notification activities for Clean water Act Section 206 only, samples shall not exceed a single sample maximum of 501/100ml.* G. pH- *Shall not vary more than one-half of a pH unit above or below that of effluent-free waters in the same geological area having a similar total salinity, alkalinity and temperature, but not lower than 6.5 or above 8.5.* H. Temperature- See Section E.12 of R.61-68. (http://www.scdhec.gov/environment/water/regs/r61-68.pdf) I. Turbidity- Not to exceed 25 NTUs provided existing uses are maintained.

Source: *SC DHEC, 2008 R.61-68, Water Classifications and Standards*

APPENDIX C- SC DHEC Ambient Water Quality Monitoring Stations

The following list of ambient water quality monitoring stations include sites that have historically been monitored on a routine basis as part of SC DHEC's ambient water quality monitoring program. As budget constraints have caused SC DHEC to scale back their statewide monitoring efforts, the frequency of samples taken at each of the monitoring sites listed below is likely going to fluctuate on a year to year basis depending on the availability of funding resources.

Table C1: SC DHEC Ambient Water Quality Monitoring Stations in Williamsburg County

Station #	Stream Classification	Location	Station Type/ Status
RS-10397	FW	Long Branch at culvert at Moulds Rd.	Random Site/ Active
PD-227	FW-SP	Black River at S-45-35, 8.6 mi NW of Kingstree	Base Site/ Active
PD-203	FW-SP	Pudding Swamp at SC 527, 8.1 mi NW of Kingstree	Base Site/ Active
PD-359	FW-SP	Black River at S-45-30	Base Site/ Active
PD-360	FW	Black Mingo Creek at S-45-121	Inactive
PD-358	FW	Kingstree Swamp Canal at SC 527	Inactive
PD-045	FW- SP	Black River at SC 377 at Bryan's Crossroads	Inactive
PD-044	FW- SP	Black River at US 52 at Kingstree	Inactive
PD-314	FW	Singleton Swamp at S-21-67	Inactive
ST-001	FW	Santee River at SC 41/ US 17A, NE of Jamestown	Base Site/ Active
ST-016	FW	Santee River at US 52, 6.5 mi NNW of St Stephens	Base/ Active
PD-172	FW	Black Mingo Creek at SC 51, 14.0 mi NE of Andrews	Inactive
PD-172	FW	Black Mingo Creek at SC 51, 14.0 mi NE of Andrews	Inactive

Source: *2010 State of South Carolina Monitoring Strategy- SC DHEC, Bureau of Water.*

Table C2: SC DHEC Ambient Water Quality Monitoring Stations in Georgetown County

Station #	Stream Classification	Location	Station Type/ Status
RS-10349	FW	Lanes Creek at SC 51 just north of Oatland	Random Site/ Active
RT-10129	SA	Minim Creek- 5.40 mi ESE of NE end of US 17 Bridge over N Santee River	Random Site/ Active
RS-10401	FW	Pee Dee River at Ports Hill Landing at the end of Co Rd S-22-753, 9.5 Mi SE of Hemingway	Random Site/ Active
RO-10380	SB	Winyah Bay, 1.70 mi West of western most point of Marsh Islands and 5.40 mi South of Waccamaw PT	Random Site/ Active
MD-077	SV	Sampit River at US 17	Base Site/ Active
MD-138	FW-SP	Waccamaw River at Channel Marker 57	Base Site/ Active
MD-142	SA-SP	Waccamaw River downstream of Butler Island at Marker 86	Base Site/ Active
PD-325	SA	Black River at S-22-489, 4.0 mi of Georgetown	Base Site/ Active
PD-361	FW	Black Mingo Creek at Cowhead Landing off SC 51	Base Site/ Active
MD-278	SB	Winyah Bay main channel, Buoy 19A Range E (05-20)	Base Site/ Active
MD-277	SFH	Parsonage Creek at Inlet Port Basin (04-17)	Base Site/ Active
MD-275	SB-SP	Pee Dee River at White House Plantation	Base Site/ Active
MD-075	SB	Sampit River between mouths of Ports Creek and Penny Royal Creek	Inactive
MD-076N	FW	Turkey Creek S-22-42 SW of Georgetown	Inactive
MD-073	SB	Sampit River opposite American Cyanamid Chem Co.	Inactive
MD-074	SB	Sampit River at Channel Marker #30	Inactive
PD-061	FW	Pee Dee River at US 701, 2.75 mi NE of Yauhannah	Inactive
PD-060	FW	Pee Dee River at Peters Field Landing off S-22-36 US IP pump station	Inactive
MD-149	SB	Whites Creek 100 yards upstream of junction with Sampit River	Inactive
MD-263	ORW, SFH	Santee Bay at Beach Creek (06A-03)	Inactive
MD-080	SB	Winyah Bay at junction of Pee Dee and Waccamaw at Marker 92	Inactive
PD-172	FW	Black Mingo Creek at SC 51, 14.0 mi NE of Andrews	Inactive
PD-170	FW-SP	Black River at SC 51, 11.6 mi NE of Andrews	Inactive
ST-005	FW,SA	N Santee River at US 17	Base Site/ Active
ST-006	FW, SA	S Santee River at US 17	Base Site/ Active

Source: *2010 State of South Carolina Monitoring Strategy- SC DHEC, Bureau of Water.*

Table C3- SC DHEC Ambient Water Quality Monitoring Stations in Horry County			
Station #	**Stream Classification**	**Location**	**Station Type/ Status**
RS-10389	FW	Brown Swamp at US 701	Random Site/ Active
MD-107	FW	Kingston Lake near pump station on Lakeside Dr. Conway	Base Site/ Active
MD-085	FW	Intracoastal Waterway at point 3.0 mi north of bridge on US 501	Base Site/ Active
MD-125	FW,SA	Intracoastal Waterway(Little River) on SC 9 (US 17)	Base Site/ Active
MD-127	FW	Intracoastal Waterway at SC 544, 7.5 mi SW of Myrtle Beach	Base Site/ Active
MD-145	FW-SP	Waccamaw River, 1.0 mi downstream of Bucksville Landing at Big Bend in river	Base Site/ Active
PD-038	FW	Lumber River at US 76 at Nichols	Base Site/ Active
PD-176	FW-SP	Lake Swamp at S-26-99	Base Site/ Active
PD-350	ORW, FW	Little Pee Dee River off end of 2-26-135 at Punchbowl Landing	Base Site/ Active
PD-352	FW-SP	Chinners Swamp at Gunters Island Road off S-26-99	Base Site/ Active
PD-373	FW-SP	Waccamaw River at S-26-31(Old Site RS-02481)	Base Site/ Active
MD-276	SFH	House Creek at 53rd Ave. out from boat landing (01-19)	Inactive
PD-042	ORW, FW	Little Pee Dee River at US 501, Galivant's Ferry	Inactive
MD-162	SA	Little River at S end of ISL due E of Town	Inactive
MD-158	FW	Crabtree Swamp at Long St. below outfall of Conway #1 Pond	Inactive
MD-146	FW-SP	Waccamaw River and Intracoastal Waterway, 1.0 mi below junction at Bucksport Landing	Inactive
MD-137	FW-SP	Waccamaw River near mouth of Bull Creek at Channel Marker 50	Inactive
MD-124	FW-SP	Waccamaw River at SC 9, 7.0 mi W of Cherry Grove	Inactive
MD-111	FW-SP	Waccamaw River at Cox's Ferry on County Rd 110	Inactive
MD-110	FW-SP	Waccamaw River at US 501 bypass around Conway	Inactive
MD-091	FW	Intracoastal Waterway, 4.0 mi N of bridge on US 501	Inactive
MD-089	FW	Intracoastal Waterway, 2.0 mi S of bridge on US 501	Inactive
MD-088	FW	Intracoastal Waterway, 1.0 mi S of bridge on US 501	Inactive
MD-087	FW	Intracoastal Waterway, just N of bridge on US 501	Inactive
MD-136	FW-SP	Waccamaw River, ¼ mi upstream of junction with Intracoastal Waterway	Inactive
PD-351	ORW, FW	Cedar Creek at S-26-23	Inactive
PD-362	FW	Buck Creek at SC 905	Inactive
PD-363	FW	Simpson Creek at SC 905	Inactive
PD-369	FW-SP	Waccamaw River at S-26-105, Reeves Ferry Road	Inactive
PD-177	FW-SP	Chinners Swamp at S-26-24, 1.9 mi SSE of Aynor	Inactive
PD-189	ORW, FW	Little Pee Dee River at US 378, 12 mi W of Conway	Inactive
PD-061	FW	Pee Dee River at US 701, 2.75 mi NE of Yauhannah	Inactive
Source: *2010 State of South Carolina Monitoring Strategy- SC DHEC, Bureau of Water.*			

APPENDIX D- 2010 SC 303(d) List of Impaired Waterbodies

Table D1 2010 303(d) List of Impaired Waters- Horry County					
12- Digit HUC Code	Location	Monitoring Station	Designated Use	Cause of Impairment	Target TMDL Date
Little River/ Atlantic Intracoastal Waterway HUC#:03040208-03					
030402080301	Intracoastal Waterway (Little River) on SC 9 (US 17)	MD-125	AL	CU	2018
030402080301	Intracoastal Waterway at North Myrtle	MD-163	FISH	HG	2023
030402080305	Little River Jetty	01-01	SHELLFISH	FC	2014
030402080305	Mouth of Dunn Sound Creek	01-02	SHELLFISH	FC	2014
030402080305	Big Bend up Dunn Sound Creek	01-05	SHELLFISH	FC	2014
030402080305	Bridge to Waites Island	01-06	SHELLFISH	FC	2014
030402080306	Hog Inlet	01-07	SHELLFISH	FC	2017
030402080306	42nd Avenue- Cherry Grove	01-17	SHELLFISH	FC	2017
030402080306	53rd Ave. Bridge on Canal	01-17A	SHELLFISH	FC	2017
030402080306	Dunn Sound at Hog Inlet	01-18	SHELLFISH	FC	2017
030402080306	Main Creek at 53rd Avenue	01-19	SHELLFISH	FC	2017
030402080306	White Point Swash	02-01	SHELLFISH	FC	2017
030402080306	House Creek at 53rd Ave out from boat landing (01-19)	MD-276	AL	DO	2017
030402080306	WAC-005A-7th Ave S	WAC-005A	REC	ENTERO	2017
030402080306	WAC-09A- Whitepoint Swash	WAC-009A	REC	ENTERO	2017
030402080307	Singleton Swash	02-02	SHELLFISH	FC	2017
030402080307	Canepatch Swash	02-03	SHELLFISH	FC	2017
030402080307	WAC-015 Singleton Swash Arcadia	WAC-015	REC	ENTERO	2017
030402080307	Bear Branch Swash	WAC-015A	REC	ENTERO	2017
030402080308	Withers Swash	03-01	SHELLFISH	FC	2017
030402080308	Midway Swash- Pebble Beach	03-02	SHELLFISH	FC	2017
030402080308	WAC-025A-Midway Swash	WAC-025A	REC	ENTERO	2017
030402080314	WAC-016A- Cane Patch Swash MB	WAC-016A	REC	ENTERO	2017
030402080314	WAC-017A- Deep Head Swash MB	WAC-017A	REC	ENTERO	2017
030402080315	WAC-020-24th Ave. North MB	WAC-020	REC	ENTERO	2017
030402080315	WAC-022A- Withers Swash	WAC-022A	REC	ENTERO	2017
030402080316	WAC-028-Pirateland Swash	WAC-028	REC	ENTERO	2017
030402080316	WAC-29A-S Ocean Lakes	WAC-029A	REC	ENTERO	2017
030402080316	WAC-31A- Swash at 5th	WAC-031A	REC	ENTERO	2017
Lumber River Watershed HUC#: 03040203-14					
030402031404	Lumber River @ Ricefield Cove	PD-038	FISH	HG	2023
030402031404	Lumber River @Causey Landing	PD-664	FISH	HG	2023
Lake Swamp Watershed HUC#: 03040204-06					
030402040601	Bob's Branch At Bridge on S-26-637, 2.2 MI N of Green Sea	RS-06009	AL	DO	2022
030402040604	Loosing Swamp at S-26-23 3.7 MI NE of Aynor	RS-03513	AL	DO	2013
Little Pee Dee River Watershed HUC#: 03040204-08					
030402040801	Cedar Creek at S-26-23	PD-351	AL	DO	2012
030402040803	Little Pee Dee River at Sandy Bluff	PD-054	FISH	HG	2023
030402040808	Little Pee Dee River at Gunter's Lake	PD-657	FISH	HG	2023
030402040808	Little Pee Dee River at Hughes Landing	PD-691	FISH	HG	2023
030402040810	Little Pee Dee River at Punchbowl Landing	PD-350	FISH	HG	2023
030402040810	Little Pee Dee River at Hwy 378	PD-620	FISH	HG	2023

Note: *Abbreviations include AL: Aquatic Life, REC: Recreation, CU: Copper, FC: Fecal Coliform, DO: Dissolved Oxygen, ENTERO: Enterococci, HG: Mercury.*

Source: *SC Department of Health and Environmental Control, The State of South Carolina's 2010 Integrated Report. Part I: Listing of Impaired Waters.*

Table D1 2010 303(d) List of Impaired Waters- Horry County Continued					
12- Digit HUC Code	Location	Monitoring Station	Designated Use	Cause of Impairment	Target TMDL Date
Kingston Lake Watershed HUC#: 03040206-08					
030402060802	Hellhole Swamp at S-26-67 6.6 MI SW of Loris	RS-05561	AL	DO	2021
030402060803	Kingston Lake Near Pump Station on Lakeside Dr. Conway	MD-107	AL	DO	2022
030402060803	Kingston Lake Near Pump Station on Lakeside Dr. Conway	MD-107	REC	FC	2011
030402060803	Crabtree Swamp At Long St. BL Outfall of Conway #1 Pond	MD-158	AL	DO	2021
030402060803	Crabtree Swamp At Long St. BL Outfall of Conway #1 Pond	MD-158	REC	FC	2014
030402060803	Crabtree Swamp at Bridge on US 501 1.5 MI NW of Conway	RS-04375	AL	DO	2021
030402060803	Crabtree Swamp at Bridge on US 501 1.5 MI NW of Conway	RS-04375	REC	FC	2014
Great Pee Dee River/ Winyah Bay Watershed HUC#: 03040207-02					
030402070205	Great Pee Dee River above Hwy 701 Bridge	CSTL-559	FISH	HG	2023
Waccamaw River Watershed HUC#: 03040206-09					
030402060901	Waccamaw River at S-26-105 Reeves Ferry Road	PD-369	REC	FC	2023
030402060902	Waccamaw River at SC 31	CSTL-553	FISH	HG	2023
030402060902	Waccamaw River at SEC RD 105	CSTL-554	FISH	HG	2023
030402060903	Steritt Swamp at Bridge on Steritt Swamp Rd Across from Horry Co Solid Waste Authority	RS-06165	AL	DO	2020
030402060903	Steritt Swamp at Bridge on Steritt Swamp Rd Across from Horry Co Solid Waste Authority	RS-06165	REC	FC	2014
030402060904	Waccamaw River at SEC Rd 901	CSTL-555	FISH	HG	2023
030402060905	Waccamaw River at Pitch Landing	CSTL-556	FISH	HG	2023
030402060905	Waccamaw River at Toddville	MD-144	FISH	HG	2023
030402060905	Bear Swamp at S-26-110	PD-638	AL	BIO	2017
030402060906	Intracoastal Waterway at Socastee	CSTL-558	FISH	HG	2023
030402060906	Unnamed Tributary to Intracoastal Waterway at SC 707 1.2 MI NE of Socastee and SC544	RS-03332	REC	FC	2014
030402060907	Waccamaw River at Peach Tree	MD-136	FISH	HG	2023
030402060907	Waccamaw River at Bucksville	MD-145	FISH	HG	2023
Waccamaw River Watershed HUC#: 03040206-10					
030402061002	Waccamaw River at Bucksport Landing	CSTL-557	FISH	HG	2023
Waccamaw River Watershed HUC#: 03040206-07					
030402060704	Waccamaw River at SC 9 7.0 MI W of Cherry Grove	MD-124	FISH	HG	2023

Note: *Abbreviations include AL: Aquatic Life, REC: Recreation, FC: Fecal Coliform, DO: Dissolved Oxygen, HG: Mercury.*
Source: *SC Department of Health and Environmental Control, The State of South Carolina's 2010 Integrated Report. Part I: Listing of Impaired Waters.*

Table D2 2010 303(d) List of Impaired Waters- Georgetown County					
12- Digit HUC Code	Location	Monitoring Station	Designated Use	Cause of Impairment	Target TMDL Date
North Santee River Watershed, HUC Code: 03050112-04					
030501120402	Wadmacon Creek at Sandhole	CSTL-586	FISH	HG	2023
030501120402	Wadmacon Creek at the Bluff	CSTL-587	FISH	HG	2023
030501120403	North Santee River at Beach Creek	06A-03	SHELLFISH	FC	2019
030501120403	North Santee Inlet	06A-04	SHELLFISH	FC	2019
030501120403	North Santee Bay- E of Cane Island (C6-97)	06A-04A	SHELLFISH	FC	2019
030501120403	North Santee River SW of Cane Island (C6-97)	06A-04B	SHELLFISH	FC	2019
030501120403	North Santee River Near the Northwestern Tip of Cone Island (C-3/-01)	06A-04C	SHELLFISH	FC	2019
030501120403	North Santee River and Mosquito Creek	06A-05	SHELLFISH	FC	2019
030501120403	AIWW at Minum Creek	06A-11	SHELLFISH	FC	2019
030501120403	North Santee River at Harris Landing	CSTL-593	FISH	HG	2023
030501120403	Minim Creek, 9 MI S of Georgetown	RT-01654	AL	TURBIDITY	2012
030501120403	North Santee River at Pole Yard	ST-005	FISH	HG	2023
South Santee River Watershed HUC#: 03040112-03					
030501120303	South Santee River at Alligator Creek	06A-01	SHELLFISH	FC	2010
030501120303	South Santee Inlet	06A-02	SHELLFISH	FC	2010
Great Pee Dee River/ Winyah Bay Watershed HUC#: 03040207-02					
030402070204	Pee Dee River at Peters Field Landing off S-22-36 US IP Pump Station	PD-060	FISH	HG	2023
030402070207	Winyah Bay at JCT of Pee Dee and Waccamaw at Marker 92	MD-080	AL	DO,PH	2023
030402070207	Great Pee Dee River at Samworth WMA	PD-663	FISH	HG	2023
030402070207	Cypress Creek at Bridge on S-22-264 1.5 MI SE of Plantersville	RS-06013	REC	FC	2019
030402070208	Jones Creek at Nancy Creek	05-01	SHELLFISH	FC	2014
030402070208	Oyster Bay near Cutoff Creek	05-05	SHELLFISH	FC	2014
030402070208	Mud Bay at No Man's Friend Creek	05-06	SHELLFISH	FC	2014
030402070208	Jones Creek at Mud Bay	05-07	SHELLFISH	FC	2014
030402070208	Winyah Bay Main Channel, Buoy 19A, Range E	05-20	SHELLFISH	FC	2014
030402070208	Winyah Bay, Tip of Western Channel Island	05-25	SHELLFISH	FC	2014
North Inlet Watershed HUC#: 03040208-04					
030402080402	Debidue Creek at Boat Basin	05-13	SHELLFISH	FC	2014
Sampit River Watershed HUC#: 03040207-01					
030402070103	Sampit River Between Mouths of Ports Creek and Penny Royal Creek	MD-075	AL	DO	2016
030402070106	Sampit River Opposite American Cyanamid Chemical Co	MD-073	AL	DO,PH	2016
030402070106	Sampit River at Channel Marker #30	MD-074	AL	DO, PH	2016
030402070106	Sampit River at US 17	MD-077	AL	DO	2016
030402070106	Whites Creek 100 yards upstream of JCT with Sampit River	MD-149	AL	DO	2016
030402070106	Sampit River Approximately 1.4 Miles West of US 17 Bridge	PD-628	FISH	HG	2023

Note: 1.*Abbreviations include AL: Aquatic Life, REC: Recreation, FC: Fecal Coliform, DO: Dissolved Oxygen, HG: Mercury, PH: Hydrogen Ion Concentration. BIO: Macroinvertebrate*

2. *Further investigation is planned for the impairment at the MD-080 monitoring station.*

3. *Further investigation is planned at the MD-073, MD-074, and MD-077 monitoring stations.*

Source: *SC Department of Health and Environmental Control, The State of South Carolina's 2010 Integrated Report. Part I: Listing of Impaired Waters.*

Table D2 2010 303(d) List of Impaired Waters- Georgetown County, Continued					
12- Digit HUC Code	Location	Monitoring Station	Designated Use	Cause of Impairment	Target TMDL Date
Waccamaw River Watershed HUC#: 03040206-10					
030402061002	Waccamaw River at Wacca Wache Landing	MD-138	FISH	HG	2023
030402061003	Waccamaw River at Sandy Island	MD-140	FISH	HG	2023
030402061003	Waccamaw River at Hagley Landing	MD-141	FISH	HG	2023
Black River Watershed HUC#: 03040205-09					
030402050906	Black River at Pine Tree Landing	PD-046	FISH	HG	2023
030402050906	Black River at SC 51 11.6 MI NE of Andrews	PD-170	AL	DO	2012
030402050906	Black River at SC 51 11.6 MI NE of Andrews	PD-170	FISH	HG	2023
030402050906	Black River at Old Pump Station	PD-659	FISH	HG	2023
030402050906	Black River at Pea House Landing	PD-692	FISH	HG	2023
030402050908	Greens Creek at S-22-38 7.7 MI NW of Georgetown	RS-03353	REC	FC	2011
030402050909	Black River at Peter's Creek	PD-171	FISH	HG	2023
030402050909	Black River at Rocky Point	PD-660	FISH	HG	2023
030402050910	Black River at Pringle's Ferry	PD-661	FISH	HG	2023
Black Mingo Creek Watershed HUC#: 03040205-08					
030402050806	Mingo Creek	PD-172	FISH	HG	2023
030402050806	Smith Swamp At Bridge on SC 51 12.2 MI S of Hemingway	RS-06189	AL	DO	2016

Note: *Abbreviations include AL: Aquatic Life, REC: Recreation, FC: Fecal Coliform, DO: Dissolved Oxygen, HG: Mercury.*
Source: *SC Department of Health and Environmental Control, The State of South Carolina's 2010 Integrated Report. Part I: Listing of Impaired Waters.*

Table D3 2010 303(d) List of Impaired Waters- Williamsburg County					
12- Digit HUC Code	Location	Monitoring Station	Designated Use	Cause of Impairment	Target TMDL Date
Great Pee Dee River/ Winyah Bay Watershed HUC#: 03040207-02					
030402070203	Clarks Creek at Snow Lake	PD-317	FISH	HG	2023
030402070203	Great Pee Dee River at Staples Lake	PD-621	FISH	HG	2023
Black River Watershed HUC#: 03040205-07					
030402050701	Clapp Swamp at SC 527	RS-02325	AL	DO	2012
030402050710	Black River at Kingstree	PD-044	FISH	HG	2023
Black River Watershed HUC#: 03040205-09					
030402050903	Spring gully at Bridge on US 521 3.8 MI NE of Trio	RS-04533	AL	BIO	2015
030402050906	Black River at Pumphouse Landing	PD-626	FISH	HG	2023
Black Mingo Creek Watershed HUC#: 03040205-08					
030402050805	Black Mingo Creek at S-45-121	PD-360	AL	DO	2012
Santee River Watershed HUC#: 03040112-01					
030501120106	Santee River at US Hwy 52 Landing	ST-528	FISH	HG	2023
Pudding Swamp Watershed HUC#: 03040205-05					
030402050505	Pudding Swamp At SC 527 8.1 MI NW of Kingstree	PD-203	REC	FC	2023

Note: *Abbreviations include AL: Aquatic Life, DO: Dissolved Oxygen, HG: Mercury, BIO: Macroinvertebrate.*
Source: *SC Department of Health and Environmental Control, The State of South Carolina's 2010 Integrated Report. Part I: Listing of Impaired Waters.*

Table D4- Waterbodies in the Waccamaw Region Removed from SC 2008 303(d) list of Impaired Waters

12-digit HUC Code	Description	Station	County	USE	Cause	Reason for Delisting
030402050403	Buck Creek at SC 905	PD-362	Horry	AL	CU, NI	Stanadard Attained
030402060704	Waccamaw River at SC 9, 7.0 miles West of Cherry Grove	MD-124	Horry	AL	CU	Stanadard Attained
030402060705	Simpson Creek at SC 905	PD-363	Horry	AL	NI, ZN	Stanadard Attained
030402070106	Whites Creek 100 yds upstream of JCT with Sampit River	MD-149	Georgetown	REC	FC	Stanadard Attained
030402070204	Pee Dee River at Peters Field Landing Off S-22-36 US IP pump station	PD-060	Georgetown	AI	CU	Stanadard Attained
030402070207	Pee Dee River at White House Plantation	MD-275	Georgetown	AL	CU	Stanadard Attained
030402070208	Winyah Bay Main Channel, Buoy 17 Range E	05-21	Georgetown	SHELLFISH	FC	Stanadard Attained
030402080301	Intracoastal Waterway at Point 3 miles North of Bridge on US 501	MD-085	Horry	AL	CU	Stanadard Attained
030402080306	House Creek at 53rd Ave. out from Boat Landing (01-19)	MD-276	Horry	AL	CU	Stanadard Attained
030402080310	Parsonnage Creek at Inlet Port Basin (04-17)	MD-277	Georgetown	AL	NH3N	Stanadard Attained
030402080402	Debidue Creek and Bass Hole Bay	05-16	Georgetown	SHELLFISH	FC	Stanadard Attained

Note: *Abbreviations include AL: Aquatic Life, REC: Recreation, CU: Copper, NI: Nickel, ZN: Zinc, NH3N: Nitrate, FC: Fecal Coliform*
Source: *SC Department of Health and Environmental Control, The State of South Carolina's 2010 Integrated Report. Part I: Listing of Impaired Waters.*

Table D5- 2010 List of SC Waters of Concern Little River/ Atlantic Intracoastal Waterway HUC#:03040208-03

12-digit HUC Code	Description	Station	County	Use	Concern
030402080306	WAC-010- Briarcliff Cabana	WAC-010	Horry	REC	ENTERO
030402080308	WAC-026- Nash Drive MB	WAC-026	Horry	REC	ENTERO
030402080308	WAC-019- 34th Ave North MB	WAC-019	Horry	REC	ENTERO
030402080308	WAC- 024- 23rd South MB	WAC-024	Horry	REC	ENTERO
030402080308	WAC-021- 8th Ave North MB	WAC-021	Horry	REC	ENTERO
030402080309	WAC-032-3rd Ave Surfside	WAC-032	Horry	REC	ENTERO
030402080309	WAC-031- 11th Ave N Surfside	WAC-031	Horry	REC	ENTERO
030402080309	WAC-030- 16th Ave N	WAC-030	Horry	REC	ENTERO
030402080309	WAC-033- 3rd Ave S Surfside	WAC-033	Horry	REC	ENTERO
030402080309	WAC-035 13th Ave S Surfside	WAC-035	Horry	REC	ENTERO
030402080310	WAC-036- Hawes Ave GC	WAC-036	Horry	REC	ENTERO
030402080314	WAC-018-50th Ave North MB	WAC-018	Horry	REC	ENTERO
030402080314	WAC-017-64th Ave North MB	WAC-017	Horry	REC	ENTERO
030402080314	WAC-016- 77th Ave North MB	WAC-016	Horry	REC	ENTERO
030402080316	WAC-029 Ocean Lakes CG	WAC-029	Horry	REC	ENTERO
030402080317	WAC-037 Azalea Ave GC	WAC-037	Horry	REC	ENTERO

Note: *Abbreviations include REC: Recreation, ENTERO: Enterococci.*
Source: *SC Department of Health and Environmental Control, The State of South Carolina's 2010 Integrated Report. Part I: Listing of Impaired Waters.*

APPENDIX E- Soil Profile: Horry, Georgetown, Williamsburg Counties

Horry County:

This section provides a profile and corresponding map of the major soil types that are found in Horry County. The following section describes each of the twelve major soil associations located in Horry County:

Woodington-Goldsboro-Pocomoke: This major soil association can be found in the western portions of Horry County, comprising approximately 15.5 percent of the total land area of the county. This soil series is located on nearly level and gently sloping soils and consists of a loamy or sandy surface layer and a loamy subsoil. Most of the land area with this type of soil association is poorly suited to most engineered uses due to wetness. Special design and maintenance considerations can help overcome the limitations of constructing local roads and dwelling units.

Nansemond-Pokomoke-Kenansville: This major soil association comprises over thirteen percent of the total land area within Horry County. It is found primarily on upland ridges and in moderately well-defined drainageways and consists of a sandy or loamy surface layer and a loam subsoil. Although there are several site limitations for roadway and dwelling construction in this type of soil association, due to wetness and ponding, they can generally be overcome by special design and maintenance considerations.

Goldsboro-Kenansville-Woodington: This soil association comprises approximately 5.5 percent of the total land area within Horry County. It is located on low ridges and in moderately well-defined drainageways and consists of a sandy or loamy surface layer and a loamy subsoil. Wetness and ponding severely limit most areas of this soil association for use as sites for dwellings, roads, and for most recreation uses. These limitations can generally be reduced by special design and increased maintenance.

Eulonia- Bladen- Wahee: This soil association makes up about 7.5 percent of the land area in Horry County. These soils are found in nearly level areas and in poorly defined drainageways. This association consists of loamy or sandy surface soils and clayey or loamy subsoil. This soil association can be found scattered in several locations across the county, primarily west of the Waccamaw River. Wetness and ponding severely limit most areas of this soil association for use as sites for dwellings, roads, and for most recreation uses. These limitations can generally be reduced by special design and increased maintenance.

Yauhannah-Ogeechee-Bladen: This soil association makes up approximately nineteen percent of the total land area of the county. This soil association is located on nearly level areas of the Atlantic Coast flatwoods and in poorly defined drainageways. This association consists of loamy or sandy surface layers and a loamy or clayey subsoil. Almost all areas within this soil system have shallow water tables. Wetness and ponding severely limit most areas of this soil association for use as sites for dwellings, roads, and for most recreation uses. These limitations can generally be reduced by special design and increased maintenance.

Yonges- Meggett: This soil association makes up about eight percent of the total land area in Horry County. This soil group is found in nearly level, swampy, moderately well defined drainageways. This association consists of a loamy surface layer with a loamy or clayey subsoil. Limitations due to wetness, flooding, and ponding cause major constraints in siting roads, dwellings, and septic tank absorption fields and are not easily overcome by alternative engineering designs.

Brookman-Bladen: This soil association comprises only about two percent of the total land area in Horry County. These soils are found in nearly level areas and in adjacent poorly defined drainageways. This soil group is found in nearly level areas and in adjacent poorly defined drainageways. The water table is typically very shallow in areas where this soil association is located. The composition of this soil association is a loamy surface layer with a clayey subsoil. Limitations due to wetness, flooding, and ponding cause major constraints in siting roads, dwellings, and septic tank absorption fields and are not easily overcome by alternative engineering designs.

Pocomoke-Echaw-Centenary: This soil association comprises roughly ten percent of the land area in Horry County. This soil group can be found scattered throughout the county. Commonly, it is located on low, nearly level sandy ridges and in poorly defined drainageways. This soil association is composed of loamy or sandy surface layers and a loamy or sandy subsoil. Wetness and the sandy texture of these soils limit their use as sites for dwellings, roads and for most recreation uses. These limitations can generally be reduced by special design and increased maintenance.

Lynn Haven-Leon: This soil association is found in one section of Horry County, in between North Myrtle Beach and Conway. It comprises approximately 6.5 percent of the total land area in the county. This soil group is found on low, nearly level sandy ridges and

in poorly defined drainageways. Almost all of the soils in this group have a high water table and a stained organic layer within thirty inches of the ground surface. The soil composition is typically sandy throughout. Wetness and ponding severely limit most areas of this soil association for use as sites for dwellings, roads, and for most recreation uses. These limitations can generally be reduced by special design and increased maintenance.

Lakeland-Leon-Newhan: This soil association is found along the immediate coast of Horry County and comprises approximately 4.5 percent of the total land area within the county. This soil group is found along gently sloping sand dunes and ridges adjacent to the Atlantic Ocean and in moderately defined waterways. These soils are not well suited for septic tank absorption fields due to poor filtration, but are well suited for all other engineering uses such as building and road construction.

Johnston-Rutlege: This soil association is found in swamps and on nearly level floodplains. This soil group comprises about five percent of the total land area within the county and is located primarily in the Pee Dee River floodplain and in parts of the Waccamaw River floodplain. Almost all of the areas that make up this soil association have a high water table and are generally flooded during part of the year. The soil composition is loamy or sandy throughout. Due to the major engineering constraints caused by wetness, flooding, and ponding, alternative sites for buildings and roads should be considered.

Hobonny: This soil association is found along the Waccamaw River floodplain and adjacent swamps from the City of Conway to the Georgetown County line. It makes up only about three percent of the total land area within Horry County. The soil composition consists of organic matter throughout. Most of the areas within this soil association have high water tables and are flooded for at least part of the year. Wetness, flooding, and ponding severely limit building and road construction in areas where this soil association is located. Due to significant engineering constraints, alternative locations for these types of land uses should be considered.

Georgetown County:

This section provides a profile and corresponding map of the major soil types that are found in Georgetown County. The following section describes each of the ten major soil associations located in Georgetown County:

Bohicket: This soil association is found along the coastline of Georgetown County from Murrells Inlet to the Santee River at the Charleston County line. It makes up approximately 8.5 percent of the total land area in Georgetown County. These soils are very poorly drained and are flooded daily by high coastal tides. The soil composition consists of a silty clay loam over a clayey and loamy underlying subsurface. These soils are not well suited for urban uses.

Levy: This soil association is found in low lying nearly level areas along the Waccamaw, Sampit, and Santee Rivers and adjacent backwater areas. This soil group makes up approximately 4.5 percent of the total land area within Georgetown County. This soil group is continuously saturated or flooded unless artificially drained. The soil composition includes a silty clay loam surface layer over a silty clay underlying material. Due to the high water table and significant engineering constraints, this soil association is not well suited for most types of urban uses.

Chastain: This soil association is found in the upper reaches of the Pee Dee River and the Santee River in Georgetown County. It makes up about 5.5 percent of the total land area within the county. The soil group is composed of a silty clay loam surface layer over a clayey subsoil. Flooding and wetness cause severe limitations for most urban uses within this soil group.

Cape Fear: This soil association consists of four small areas that comprise a total of 3.5 percent of the land area within Georgetown County. The soil composition consists of a thick loam surface layer and an underlying clayey subsoil. The high water table and clayey subsoil that characterize this soil association cause limitations to most urban uses.

Lakeland-Chipley-Centenary: This soil association comprises 11.5 percent of the total land area in Georgetown County. This soil group is characterized as being sandy throughout. The soils within this group are well suited to moderately suited for urban uses.

Leon-Lynn Haven-Chipley: This soil association make up about 7.5 percent of the total land area within Georgetown County and is found primarily along the Waccamaw Neck section of the county. This soil group is characterized as having both sandy surface and subsurface soil layers. This soil group is considered moderately to poorly suited for urban uses because of the area's high water table.

Yauhannah-Yemassee: This soil association makes up 26 percent of the total land area of Georgetown County, a significant proportion of the soils found throughout the county. This soil group consists of a surface and subsurface layer of loamy fine sand. This soil group is considered to be poorly to moderately suited for most urban uses due to the high water table.

Bladen-Wahee-Eulonia: This is the largest soil association within Georgetown County, comprising over 29 percent of the total land area within the county. This soil group is found in the western half of Georgetown County. The soil composition consists of a surface layer of fine sandy loam with a clayey subsoil. The soils within this group are considered poorly suited for most urban uses because of the high water table and the clayey subsoil.

Hobonny: This is a small soil association, comprising less than three percent of the total land area within Georgetown County. It is located in the floodplains of the Black River, Mingo Creek, and in the upper reaches of the Waccamaw River. The soil composition consists of organic matter throughout and is continuously saturated or flooded throughout the year. These soft soils are not suited for any type of urban use.

Johnston-Hobcaw: This is the smallest soil association found in Georgetown County, comprising one percent of the county's total land area. It is characterized as having a thick loam surface layer and a sandy loam subsurface layer. This soil group is considered poorly suited for urban uses due to ponding and wetness.

Williamsburg County:

This section provides a profile and corresponding map of the major soil types that are found in Williamsburg County. The following section below describes each of the twelve major soil associations located in Williamsburg County:

Foreston-Autryville-Candor: This soil association comprises approximately seven percent of the total land area in Williamsburg County. Typically, this soil group consists of a fine sand surface layer with a fine sandy loam subsoil. This soil group is well to moderately suited for most urban uses. Special consideration should be given to siting septic system absorption fields in Foreston type soils due to seasonal high water table conditions.

Lynchburg-Rains: This soil association makes up twelve percent of the entire land area within Williamsburg County. These soils consists of a fine sandy loam surface layer and a sandy clay loam subsoil. The seasonal high water table poses significant constraints to most types of community development. Surface drainage techniques can minimize this problem, however special design and installation procedures are required for septic tank absorption fields.

Goldsboro-Noboco-Coxville: This soil association makes up seventeen percent of the total land area in Williamsburg County. The Goldsboro and Noboco soils consist of a loamy fine sand surface layer and a sandy clay loam subsoil. The Coxville soils have a loam surface layer and a clay loam and clay subsoil. This soil group is very poorly suited to most types of community development. Surface drainage techniques can be applied to minimize constraints due to the high seasonal water table. Special design and installation techniques are necessary for siting septic tank absorption fields.

Yemassee-Ogeechee-Eunola: This soil association comprises eleven percent of the total land area in Williamsburg County. This soil group is characterized by a sandy loam surface layer and a sandy clay loam subsoil. These soils are considered to be moderately well suited to very poorly suited for most types of community development. Surface drainage techniques can be applied to minimize constraints due to the high seasonal water table. Special design and installation techniques are necessary for siting septic tank absorption fields.

Eunola-Emporia-Yemassee: This soil association comprises eighteen percent of the total land area within Williamsburg County. The typical landscape where these soils can be found is characterized by low ridges, flat areas, and slight depressions. The soil composition consists of a sandy loam surface layer and a sandy clay loam subsoil. This soil group is considered well to very poorly suited for most types of community development with the seasonal high water table being the biggest site management concern.

Coxville-Byars: This is a relatively small soil association, comprising about four percent of the total land area in Williamsburg County. The landscape within these soil areas is flat with several depressional areas and Carolina Bays. The Coxville soils have a loam surface layer and a clay loam and clay subsoil. The Byars soils have a sandy loam surface layer and a clay loam subsoil. This soil group is considered to be very poorly suited for most types of community development projects. The depth of the seasonal high water table and site permeability are the primary site management concerns.

Gourdin-Cape Fear: This is a very small soil association comprising only one percent of the total land area in Williamsburg County. The landscape is flat and Carolina Bays are present. The Gourdin soils consist of a loam surface layer and a sandy clay loam subsoil. The Cape Fear soils have a sandy loam surface with a sandy clay loam subsoil. This soil group is very poorly suited for most types of community development, with wetness being the main site management constraint.

Wahee-Hornsville-Gourdin: This soil association makes up about five percent of the total land area within Williamsburg County. The Wahee and Hornsville soils consist of a sandy loam surface layer and a clay subsoil. The Gourdin soils consist of a loam surface layer and a sandy clay loam subsoil. This soil group is moderately well suited to very poorly suited to most types of community development. The seasonal high water table and slow permeability are the major limitations for most uses. Surface drainage techniques can be applied to minimize constraints due to the high seasonal water table. Special design and installation techniques are necessary for siting septic tank absorption fields.

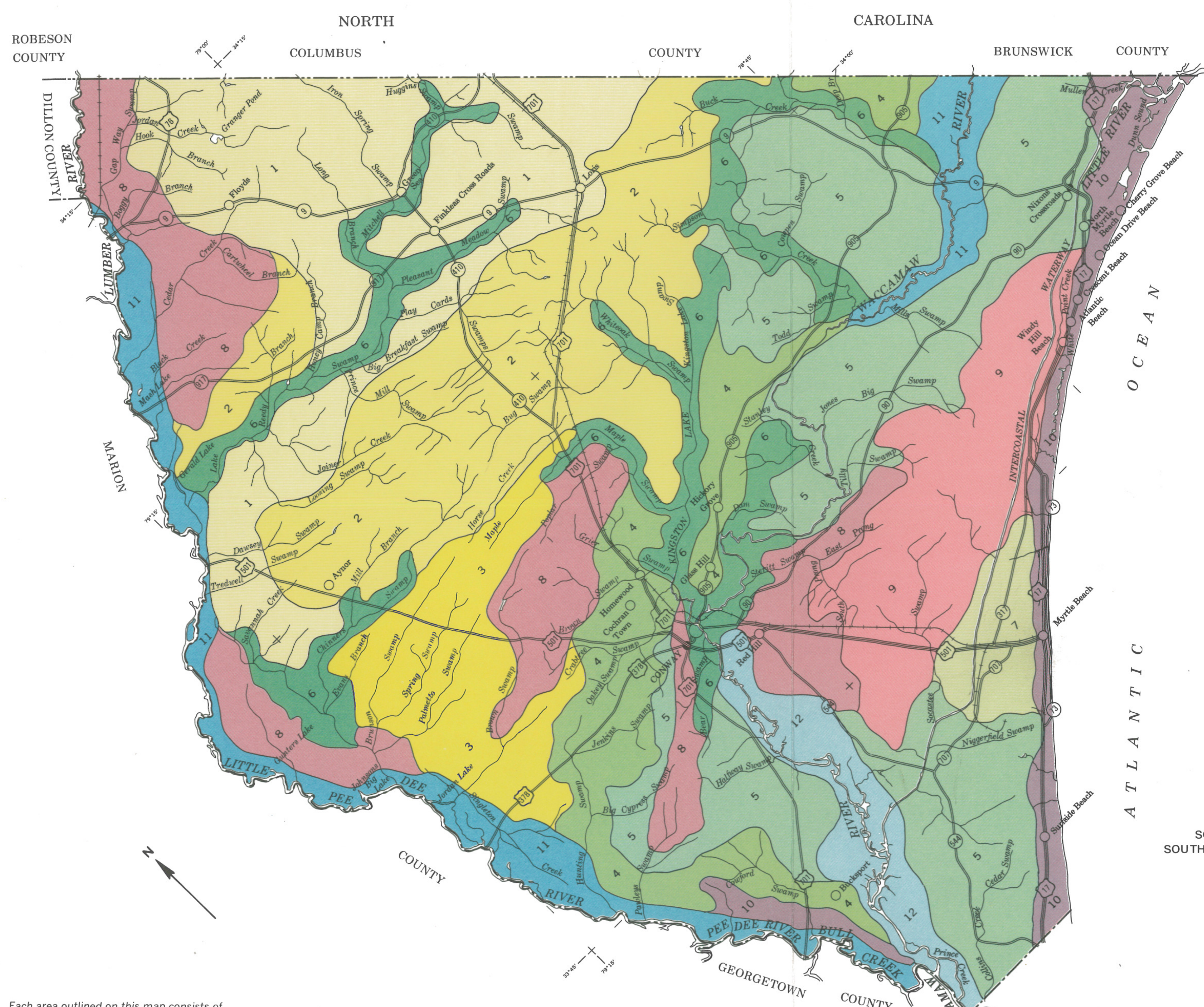
Emporia-Chisolm-Hornsville: This soil association comprises about ten percent of the total land area within Williamsburg County. These soil groups parallel some of the major rivers within Williamsburg County such as the Santee River, the Black River, and Black Mingo Creek. The landscape consists of broad, rolling ridges, and narrow gently sloping to sloping side slopes separating broad flats and floodplains. The Emporia and Chisolm soils consist of loamy fine sand surface layer and a sandy clay loam subsoil. The Hornsville soils consist of a sandy loam surface layer and a clay subsoil. This soil group is well to moderately well suited for most types of community development. Depth to the seasonal high water table of all the soils and permeability of the Hornsville soils are the primary site limitations. These limitations can be reduced by providing surface drainage and by modifying conventional septic tank system design for onsite sewage treatment.

Mouzon-Hobcaw-Chipley: This soil association makes up about nine percent of the total land area in Williamsburg County. These soils are found in the direct floodplains of the Back River and Black Mingo Creek. The Mouzon and Hobcaw soils have a sandy loam surface layer and a sandy clay loam subsoil. The Chipley soils have a sand surface layer and a sandy subsoil. Wetness and flood hazards limit this soil group for any type of community development.

Chastain-Tawcaw: This soil association comprises five percent of the total land area within Williamsburg County. It is located primarily along the floodplain of the Santee River at the southern end of the county. These soils are characterized as having both clay surface and subsoil layers. Due to flooding and wetness, these soils are very poorly suited for any type of community development project.

Nahunta Variant-Daleville Variant-Izagora Variant: This is a very small soil association comprising approximately one percent of the total land area in Williamsburg County. It is located in the western portion of the county and the landscape consists of flat areas, a few low ridges, and shallow depressions. The Izagora Variant and Daleville Variant soils consist of a loam surface layer and a loam or clay loam subsoil. The Nahunta Variant subsoils have a sandy loam surface layer and a sandy loam and loam subsoil. This soil group is considered very poorly suited to moderately well suited to most types of community development. Surface drainage techniques can be applied to minimize constraints due to the high seasonal water table. Special design and installation techniques are necessary for siting septic tank absorption fields.

This Page Has Been Left Blank Intentionally



LEGEND

NEARLY LEVEL AND GENTLY SLOPING SOILS THAT HAVE A LOAMY SUBSOIL

1 Woodington-Goldsboro-Pocomoke: Poorly drained, moderately well drained, and very poorly drained soils that have a loamy or sandy surface layer and a loamy subsoil: on broad, nearly level and slightly concave areas

2 Nansemond-Pocomoke-Kenansville: Moderately well drained, very poorly drained, and well drained soils that have a sandy or loamy surface layer and a loamy subsoil: on broad, nearly level and gently sloping areas

3 Goldsboro-Kenansville-Woodington: Moderately well drained, well drained, and poorly drained soils that have a sandy or loamy surface layer and a loamy subsoil: on broad, nearly level and gently sloping areas

NEARLY LEVEL AND GENTLY SLOPING SOILS THAT HAVE A CLAYEY OR LOAMY SUBSOIL

4 Eulonia-Bladen-Wahee: Moderately well drained, poorly drained, and somewhat poorly drained soils that have a loamy or sandy surface layer and a clayey or loamy subsoil: on nearly level and gently sloping areas

5 Yauhannah-Ogeechee-Bladen: Moderately well drained and poorly drained soils that have a loamy or sandy surface layer and a loamy or clayey subsoil; on broad, nearly level areas

6 Yonges-Meggett: Poorly drained soils that have a loamy surface layer and a loamy or clayey subsoil: in drainageways, on flood plains, and on nearly level areas

7 Brookman-Bladen: Very poorly drained and poorly drained soils that have a loamy surface layer and a clayey subsoil: in broad, nearly level depressions and on flats

NEARLY LEVEL AND GENTLY SLOPING SOILS THAT HAVE A SANDY OR LOAMY SUBSOIL

8 Pocomoke-Echaw-Centenary: Very poorly drained and moderately well drained soils that have a loamy or sandy surface layer and a loamy or sandy subsoil: in drainageways and on nearly level areas

9 Lynn Haven-Leon: Poorly drained soils that are sandy throughout: in drainageways and on nearly level areas

10 Lakeland-Leon-Newhan: Excessively drained and poorly drained soils that are sandy throughout: in drainageways, on broad ridges and slopes, and on dunes

NEARLY LEVEL SOILS IN FLOOD PLAIN AREAS AND DRAINAGEWAYS

11 Johnston-Rutlege: Poorly drained soils that are loamy or sandy throughout; in drainageways and on flood plains

12 Hobonny: Poorly drained soils that are organic throughout; on flood plains

Compiled 1984

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION
SOUTH CAROLINA LAND RESOURCES CONSERVATION COMMISSION

GENERAL SOIL MAP
HORRY COUNTY SOUTH CAROLINA

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

LEGEND

DOMINANTLY NEARLY LEVEL SOILS THAT ARE SUBJECT TO FLOODING OR PONDING AND THAT HAVE A CLAYEY SUBSOIL OR CLAYEY UNDERLYING MATERIAL

1 — Bohicket: Nearly level, very poorly drained soils that are flooded daily by ocean tides

2 — Levy: Nearly level, very poorly drained soils along the major rivers and backwater areas

3 — Chastain: Nearly level, poorly drained soils along the upper reaches of the major rivers

4 — Cape Fear: Nearly level, very poorly drained soils in depressions

DOMINANTLY NEARLY LEVEL TO GENTLY SLOPING SOILS THAT ARE SANDY THROUGHOUT

5 — Lakeland-Chipley-Centenary: Nearly level to gently sloping, excessively drained and moderately well drained soils

6 — Leon-Lynn Haven-Chipley: Nearly level, poorly drained and moderately well drained soils

DOMINANTLY NEARLY LEVEL UPLAND SOILS THAT HAVE A LOAMY SUBSOIL

7 — Yauhannah-Yemassee: Nearly level, moderately well drained and somewhat poorly drained soils

DOMINANTLY NEARLY LEVEL UPLAND SOILS THAT HAVE A CLAYEY SUBSOIL

8 — Bladen-Wahee-Eulonia: Nearly level, poorly drained to moderately well drained soils

DOMINANTLY NEARLY LEVEL SOILS THAT ARE SUBJECT TO FLOODING OR PONDING AND THAT ARE ORGANIC THROUGHOUT OR HAVE SANDY UNDERLYING MATERIAL OR A LOAMY SUBSOIL

9 — Hobonny: Nearly level, very poorly drained organic soils on flood plains

10 — Johnston-Hobcaw: Nearly level, very poorly drained soils in depressions

Compiled 1981

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION
SOUTH CAROLINA LAND RESOURCES CONSERVATION COMMISSION

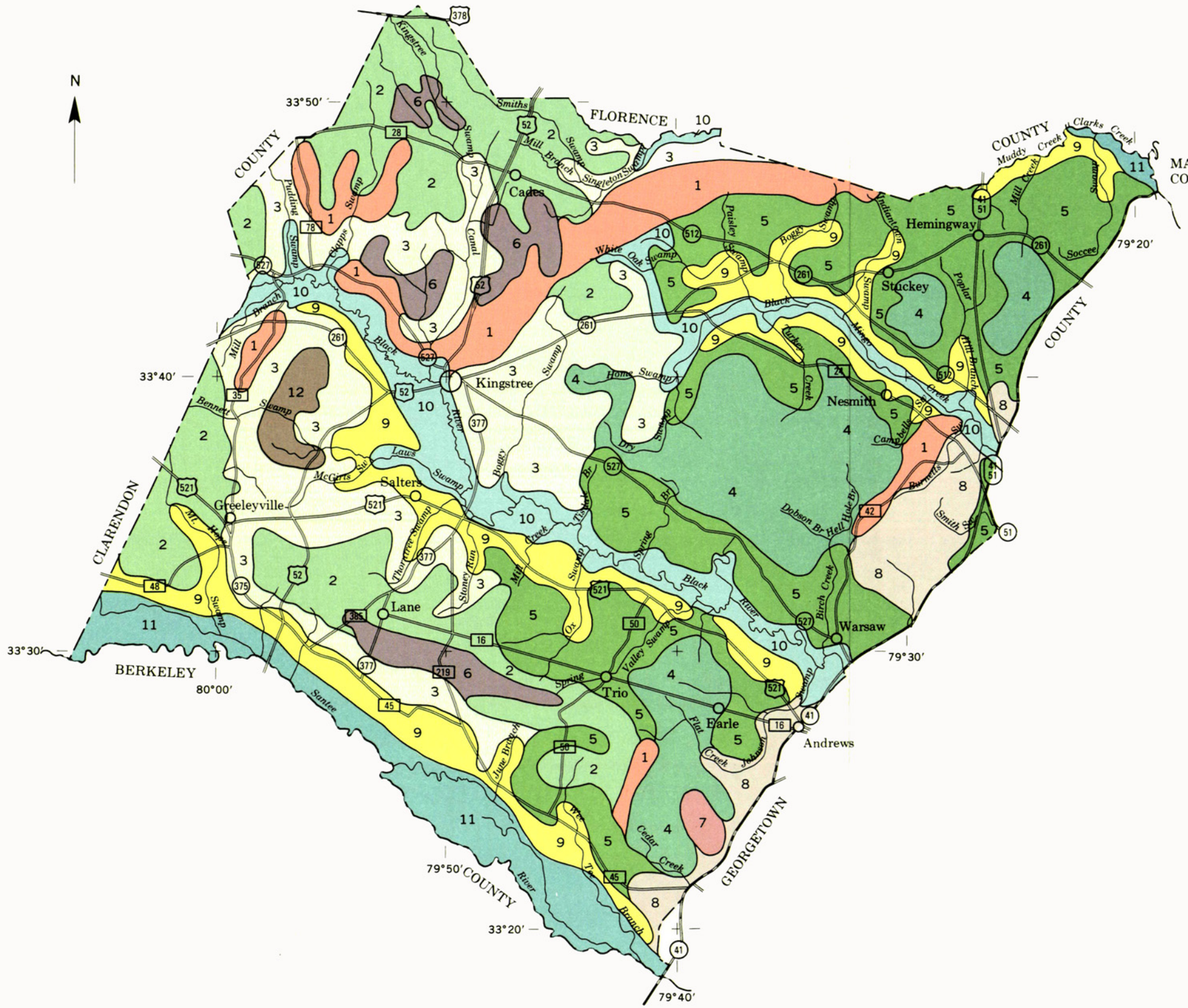
GENERAL SOIL MAP

GEORGETOWN COUNTY, SOUTH CAROLINA

Scale 1:316,800

1 0 1 2 3 4 5 Miles

1 0 5 10 Km



LEGEND

DOMINANTLY NEARLY LEVEL SOILS THAT ARE MODERATELY WELL DRAINED TO SOMEWHAT EXCESSIVELY DRAINED; ON LOW RIDGES AND RIVER TERRACES

1 — Foreston-Autryville-Candor: Nearly level, moderately well drained to somewhat excessively drained soils that have a loamy and sandy subsoil

DOMINANTLY NEARLY LEVEL SOILS THAT ARE WELL DRAINED TO POORLY DRAINED; ON BROAD FLATS

2 — Lynchburg-Rains: Nearly level, somewhat poorly drained and poorly drained soils that have a loamy subsoil

3 — Goldsboro-Noboco-Coxville: Nearly level, moderately well drained, well drained, and poorly drained soils that have a loamy and clayey subsoil

4 — Yemassee-Ogeechee-Eunola: Nearly level, somewhat poorly drained, poorly drained, and moderately well drained soils that have a loamy subsoil

5 — Eunola-Emporia-Yemassee: Nearly level, moderately well drained, well drained, and somewhat poorly drained soils that have a loamy and clayey subsoil

DOMINANTLY NEARLY LEVEL SOILS THAT ARE MODERATELY WELL DRAINED TO VERY POORLY DRAINED; ON BROAD FLATS AND IN CAROLINA BAYS

6 — Coxville-Byars: Nearly level, poorly drained and very poorly drained soils that have a clayey and loamy subsoil

7 — Gourdin-Cape Fear: Nearly level, poorly drained and very poorly drained soils that have a loamy subsoil

8 — Wahee-Hornsville-Gourdin: Nearly level, somewhat poorly drained, poorly drained, and moderately well drained soils that have a clayey and loamy subsoil

DOMINANTLY GENTLY SLOPING TO SLOPING SOILS THAT ARE WELL DRAINED AND MODERATELY WELL DRAINED; ON BROAD RIDGES AND SIDE SLOPES

9 — Emporia-Chisolm-Hornsville: Gently sloping to sloping, well drained and moderately well drained soils that have a loamy and clayey subsoil

DOMINANTLY NEARLY LEVEL SOILS THAT ARE MODERATELY WELL DRAINED TO VERY POORLY DRAINED; ON FLOOD PLAINS AND LOW STREAM TERRACES

10 — Mouzon-Hobcaw-Chipley: Nearly level, poorly drained, very poorly drained, and moderately well drained soils; on flood plains and low stream terraces of the Black River and Black Mingo Creek

11 — Chastain-Tawcaw: Nearly level, poorly drained and somewhat poorly drained soils that have a clayey subsoil; on flood plains of the Pee Dee and Santee Rivers

DOMINANTLY NEARLY LEVEL SOILS THAT ARE MODERATELY WELL DRAINED TO POORLY DRAINED; ON BROAD FLATS

12 — Nahunta Variant-Daleville Variant-Izagora Variant: Nearly level, somewhat poorly drained, poorly drained, and moderately well drained soils that have a loamy subsoil

Compiled 1987

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION
SOUTH CAROLINA LAND RESOURCES CONSERVATION COMMISSION

GENERAL SOIL MAP
WILLIAMSBURG COUNTY
SOUTH CAROLINA

Scale 1:316,800

1 0 1 2 3 4 5 Miles

1 0 5 10 Km

Table E-1: Horry County Soil Characteristics							
Soil Type	Acreage	% of land area	Erosion Factor (K)	Septic Tank Absorption Limitations	Hydrological Group	High Water Table Depth	Seasonal High Water Table Months
Beaches	1,540	0.2%					
Bladen	32,295	4.4%	0.24	**Severe:** ponding, percs slowly	D	+1-1.0ft	Dec-May
Blanton	13,815	1.9%	0.10-0.20	**Moderate:** wetness	A	5.0-6.0ft	Dec-May
Bohicket	2,705	0.4%	0.24-0.28	**Severe:** flooding, ponding, percs slowly	D	+3-0.0ft	Jan-Dec
Brookman	4,490	0.6%	0.24-0.28	**Severe:** wetness, percs slowly	D	0-1.0ft	Nov-May
Centenary	20,955	2.8%	0.10	**Severe:** wetness, poor filter	B	3.5-5.0ft	Dec-Mar
Chisolm	10,475	1.4%	0.10-0.15	**Moderate:** wetness	A	3.5-5.0ft	Jan-Mar
Coxville	6,600	0.9%	0.24-0.32	**Severe:** wetness, percs slowly	D	0.0-1.5ft	Nov-Apr
Duplin	2,835	0.4%	0.24-0.28	**Severe:** wetness, percs slowly	C	2.0-3.0ft	Dec-Apr
Echaw	18,910	2.6%	0.10	**Severe:** wetness, poor filter.	B	2.5-5.0ft	Nov-Apr
Emporia	5,530	0.8%	0.20-0.28	**Severe:** wetness, percs slowly	C	3.0-4.5ft	Nov-Apr
Eulonia A	28,755	3.9%	0.15-0.24	**Severe:** percs slowly, wetness	C	1.5-3.5ft	Dec-May
Eulonia B	2,795	0.4%	0.15-0.24	**Severe:** percs slowly, wetness	C	1.5-3.5ft	Dec-May
Goldsboro	32,705	4.4%	0.20-0.24	**Severe:** wetness	B	2.0-3.0ft	Dec-Apr
Hobcaw	11,615	1.6%	0.17-0.24	**Severe:** Ponding	D	+1.0-1.0ft	Nov-Apr
Hobonny	19,015	2.6%	N/A	**Severe:** flooding, ponding	D	+1-0.0ft	Jan-Dec
Johnston	51,125	6.9%	0.17-0.20	**Severe:** flooding, ponding, poor filter	D	+1-1.5ft	Nov-Jun
Kenansville	28,060	3.8%	0.15	**Moderate:** wetness	A	4.0-6.0ft	Dec-Apr
Lakeland	15,650	2.1%	0.10	**Slight**	A	>6.0ft	N/A
Leon	33,975	4.6%	0.10-0.15	**Severe:** wetness, poor filter	B/D	0.0-1.0ft	Jun-Feb
Lynchburg	12,040	1.6%	0.15-0.20	**Severe:** wetness	C	0.5-1.5ft	Nov-Apr
Lynn Haven	23,285	3.2%	0.10-0.15	**Severe:** wetness, poor filter	B/D	0.0-1.0ft	Jun-Feb
Meggett	34,330	4.7%	0.28-0.32	**Severe:** flooding, wetness, percs slowly	D	0.0-1.0ft	Nov-Apr
Nankin	3,025	0.4%	0.24-0.28	**Severe:** percs slowly	C	>6.0ft	N/A
Nansemond	35,435	4.8%	0.15-0.17	**Severe:** wetness	C	1.5-2.5ft	Dec-Apr
Newhan	2,930	0.4%	0.10	**Severe:** poor filter	A	>6.0ft	N/A
Norfolk	9,330	1.3%	0.20-0.24	**Severe:** percs slowly	B	3.0-6.0ft	Jan-Mar
Ogeechee	35,350	4.8%	0.10-0.15	**Severe:** wetness	B/D	0.0-0.5ft	Dec-May
Osier	4,380	0.6%	0.10	**Severe:** flooding, wetness	A/D	0.0-1.0ft	Nov-Mar
Pocomoke	38,220	5.2%	0.20-0.28	**Severe:** wetness	B/D	0.0-0.5ft	Dec-May
Rimini	2,200	0.3%	0.10	**Severe:** poor filter	A	>6.0ft	
Rutlege	18,255	2.5%	0.17	**Severe:** ponding, poor filter	B/D	+2.0-1.0ft	Dec-May
Suffolk A	8,300	1.1%	0.17-0.24	**Slight**	B	>6.0ft	N/A
Suffolk B	2,360	0.3%	0.17-0.24	**Slight**	B	>6.0ft	N/A
Summerton	1,195	0.2%	0.28	**Severe:** percs slowly	B	>6.0ft	N/A
Udorthents and Udipsamments	4,655	0.6%	0.28	**Severe:** percs slowly	B	N/A	N/A
Wahee	15,430	2.1%	0.24-0.28	**Severe:** wetness, percs slowly	D	0.5-1.5ft	Dec-Mar
Witherbee	4,395	0.6%	0.10	**Severe:** wetness, poor filter	A/D	1.0-2.0ft	Nov-Apr
Woodington	40,735	5.5%	0.10-0.20	**Severe:** wetness	B/D	0.5-1.0ft	Dec-May
Yauhannah	41,155	5.6%	0.17-0.24	**Severe:** wetness	B	1.5-2.5ft	Dec-Mar
Yemassee	15,885	2.2%	0.15-0.20	**Severe:** wetness	C	1.0-1.5ft	Dec-Mar
Yonges	29,730	4.0%	0.17-0.20	**Severe:** wetness, percs slowly	D	0.0-1.0ft	Nov-Apr
Water	9,535	1.3%					

Source: *United States Department of Agriculture: Soil Survey of Horry County, South Carolina*

Table E-2: Williamsburg County Soil Characteristics							
Soil Type	Acreage	% of land area	Erosion Factor (K)	Septic Tank Absorption Limitations	Hydrological Group	High Water Table Depth	Seasonal High Water Table Months
Autryville	5,628	0.9%	0.10-0.17	**Moderate:** Wetness	A	4.0-6.0ft	Jan-Apr
Bonneau	2,220	0.4%	0.15-0.20	**Severe:** Wetness	A	3.5-5.0ft	Dec-Mar
Byars	4,101	0.7%	0.20-0.32	**Severe:** Ponding, percs slowly	D	+1-1.0ft	Nov-Apr
Candor A	1,526	0.3%	0.10-0.20	**Slight**	A	>6.0ft	N/A
Candor B	2,186	0.4%	0.10-0.20	**Slight**	D	>6.0ft	N/A
Cape Fear	4,130	0.7%	0.15-0.32	**Severe:** wetness, percs slowly.	D	0.0-1.5ft	Dec-Apr
Chastain and Tawcaw	29,104	4.9%	0.10-0.37	**Severe:** flooding, wetness, percs slowly.	C	0.0-2.5ft	Nov-May
Chipley	6,649	1.1%	0.10	**Severe:** wetness, poor filter.	C	2.0-3.0ft	Dec-Apr
Chisolm A	14,666	2.5%	0.15	**Moderate:** wetness	A	3.0-5.0ft	Jan-Mar
Chisolm B	895	0.2%	0.15	**Moderate:** Wetness, slope	A	3.0-5.0ft	Jan-Mar
Coxville	33,176	5.6%	0.24-0.32	**Severe:** wetness, percs slowly	D	0.0-1.5ft	Nov-Apr
Daleville	1,607	0.3%	0.20	**Severe:** wetness	D	0.0-1.0ft	Nov-May
Emporia A	22,570	3.8%	0.20-0.28	**Severe:** wetness, percs slowly.	C	3.0-4.5ft	Nov-Apr
Emporia B	11,423	1.9%	0.20-0.28	**Severe:** wetness, percs slowly.	C	3.0-4.5ft	Nov-Apr
Emporia C	3,105	0.5%	0.20-0.28	**Severe:** wetness, percs slowly	C	3.0-4.5ft	Nov-Apr
Eunola	51,081	8.6%	0.17-0.24	**Severe:** wetness	C	1.5-2.5ft	Nov-Mar
Foreston	18,033	3.0%	0.10-0.20	**Severe:** wetness	C	2.0-3.5ft	Dec-Apr
Foxworth	1,000	0.2%	0.10	**Moderate:** wetness	A	4.0-6.0ft	Jun-Oct
Goldsboro	35,432	5.9%	0.17-0.24	**Severe:** wetness	B	2.0-3.0ft	Dec-Apr
Gourdin	35,277	5.9%	0.20-0.28	**Severe:** ponding, percs slowly	C	+1-1.0ft	Nov-Apr
Hobcaw	20,797	3.5%	0.17-0.24	**Severe:** flooding, ponding	D	+1-1.0ft	Nov-Apr
Hornsville A	16,771	2.8%	0.20-0.28	**Severe:** wetness, percs slowly	C	1.5-3.5ft	Dec-Apr
Hornsville B	12,453	2.1%	0.20-0.28	**Severe:** wetness, percs slowly	C	1.5-3.5ft	Dec-Apr
Izagora	1,182	0.2%	0.20	**Severe:** wetness	B	1.5-2.5ft	Dec-May
Johns	3,805	0.6%	0.10-0.24	**Severe:** wetness	C	1.5-2.5ft	Dec-Apr
Johnston	3,704	0.6%	0.17-0.20	**Severe:** flooding, ponding, poor filter.	D	+1-1.5ft	Nov-Jun
Kenansville	616	0.1%	0.15	**Moderate:** wetness	A	4.0-6.0ft	Dec-Apr
Leon	3,113	0.5%	0.10-0.15	**Severe:** wetness	B/D	0.0-1.0ft	Jun-Feb
Lynchburg	43,123	7.2%	0.20	**Severe:** wetness	C	0.5-1.5ft	Nov-Apr
Lynn Haven	475	0.1%	0.10-0.15	**Severe:** wetness	B/D	0.0-1.0ft	Jun-Feb
Mouzon and Hobcaw	41,746	7.0%	0.15-0.24	**Severe:** Flooding, wetness, percs slowly.	D	+1-1.0ft	Nov-Apr
Nahunta Variant	1,642	0.3%	0.20	**Severe:** wetness, percs slowly	C	0.5-1.5ft	Dec-May
Noboco	19,086	3.2%	0.17-0.20	**Severe:** wetness	B	2.5-4.0ft	Dec-Mar
Ogeechee	35,699	6.0%	0.10-0.15	**Severe:** wetness	B/D	0.0-0.5ft	Dec-May
Paxville	9,523	1.6%	0.10-0.20	**Severe:** ponding	B/D	+1-1.0ft	Nov-Apr
Rains	36,532	6.1%	0.20-0.28	**Severe:** wetness	B/D	0.0-1.0ft	Nov-Apr
Rimini	257	0.05%	0.10	**Severe:** Poor filter	A	>6.0ft	N/A
Rutlege	857	0.2%	0.17	**Severe:** ponding, poor filter	B/D	+2-1.0ft	Dec-May
Tomahawk	433	0.1%	0.10-0.15	**Severe:** wetness	A	1.5-3.0ft	Dec-Apr
Udorthents	483	0.1%	0.10-0.15	**Severe:** wetness	A	1.5-3.0ft	
Wahee	15,630	2.6%	0.24-0.28	**Severe:** wetness, percs slowly	D	0.5-1.5ft	Dec-Mar
Yemassee	41,602	7.0%	0.20	**Severe:** wetness	C	1.0-1.5ft	Dec-Mar
Water	2,662	0.4%					
Source: *United States Department of Agriculture, Soil Survey of Williamsburg County*							

Table E-3: Georgetown County Soil Characteristics							
Soil Type	Acreage	% of land area	Erosion Factor (K)	Septic Tank Absorption Limitations	Hydrological Group	High Water Table Depth	Seasonal High Water Table Months
Bladen	51,770	9.9%	0.10	**Severe:** wetness, percs slowly	D	0.0-1.0ft	Dec-May
Blanton	1,210	0.2%	0.17-0.32	**Severe:** poor filter	A	5.0-6.0ft	Jan-Apr
Bohicket	43,590	8.4%	0.24-0.32	**Severe:** flooding, ponding, percs slowly	D	+3-0.0ft	Jan-Dec
Cape Fear	19,720	3.8%	0.15-0.32	**Severe:** ponding, percs slowly	D	+1-1.5ft	Dec-Apr
Centenary	5,510	1.1%	0.10	**Moderate:** wetness	B	3.5-5.0ft	Dec-Mar
Chastain	28,740	5.5%	0.32-0.37	**Severe:** flooding, wetness, percs slowly.	D	0-1.0ft	Nov-May
Chipley	15,170	2.9%	0.17	**Severe:** wetness, poor filter	B	2.0-3.0ft	Nov-Apr
Chisolm	14,390	2.8%	0.10-0.15	**Moderate:** wetness	A	3.5-5.0ft	Jan-Mar
Echaw	11,800	2.3%	0.10	**Severe:** wetness, poor filter	B	2.5-5.0ft	Nov-Apr
EuloniaA	25,490	4.9%	0.20-0.24	**Severe:** percs slowly, wetness	C	1.5-3.5ft	Dec-May
EuloniaB	5,230	1.0%	0.20-0.24	**Severe:** percs slowly, wetness	C	1.5-3.5ft	Dec-May
Grifton	17,500	3.4%	0.17-0.24	**Severe:** wetness	D	0.5-1.0ft	Dec-May
Hobcaw	9,590	1.8%	0.17-0.24	**Severe:** ponding	D	+1-1.0ft	Nov-Apr
Hobonny	16,280	3.1%	0.15	**Severe:** flooding, ponding	D	+1-0.0ft	Jan-Dec
Johnston	13,350	2.6%	0.17-0.20	**Severe:** flooding, ponding, poor filter	D	+1-1.5ft	Nov-Jun
Lakeland	19,110	3.7%	0.17	**Severe:** poor filter	A	>6.0ft	N/A
Leon	18,460	3.6%	0.17-0.20	**Severe:** Wetness, poor filter	A/D	0.0-1.0ft	Nov-Apr
Levy	24,110	4.6%	0.32	**Severe:** flooding, ponding, percs slowly	D	+2-+1ft	Jan-Dec
Lynn Haven	7,480	1.4%	0.15-0.20	**Severe:** wetness, poor filter	B/D	0-1.0ft	Nov-Apr
Newhan	1,210	0.2%	0.10	**Severe:** poor filter	A	>6.0ft	N/A
Norfolk	1,540	0.3%	0.17-0.24	**Moderate:** wetness	B	4.0-6.0ft	Jan-Mar
Rutlege	8,210	1.6%	0.17	**Severe:** flooding, wetness, poor filter	D	0.0-1.0ft.	Dec-May
Wahee	47,790	9.2%	0.28	**Severe:** wetness, percs slowly	D	0.5-1.5ft	Dec-Mar
Wakulla	11,090	2.1%	0.10	**Severe:** poor filter	A	>6.0ft	N/A
Witherbee	4,420	0.9%	0.10	**Severe:** wetness, poor filter	B	0-2.0ft	Nov-Apr
Yauhannah	50,500	9.7%	0.17-0.24	**Severe:** wetness	B	1.5-2.5ft	Dec-Mar
Yemassee	33,780	6.5%	0.10-0.20	**Severe:** wetness	C	1.0-1.5ft	Dec-Mar
Water	8,920	1.7%					
Source: *United States Department of Agriculture, Soil Survey of Georgetown County*							

This Page Has Been Left Blank Intentionally

APPENDIX F- Source Water Assessment and Protection Program

The Source Water Assessment and Protection Program was established as part of the 1996 amendments to the Safe Drinking Water Act. It is an additional management strategy that helps protect the health of our water resources, in this case specifically for the protection of our drinking water sources. The Source Water Assessment is a report that provides basic information to the public water suppliers and the general public about drinking water sources. The benefits of developing Source Water Assessments are numerous and include a more secure and safe drinking water supply for the community and for its future generations, possible reduction in the costs associated with treating and distributing drinking water, and a general cost reduction through contamination prevention measures versus the expense of cleanup once contamination has occurred. These assessments allow water resource managers to develop management strategies and initiatives to minimize threats to drinking water supplies and to also identify contingency water supplies during unforeseen emergency scenarios.

The Assessments include the following components:

Source Water Protection Area (SWPA) - This includes a description of the drinking water source such as a groundwater well or surface water intake and the land area that contributes water to that source. Maps showing the location of the SWPA are included.
Potential Contaminant Source Inventory - This is a listing of the land uses and activities within the SWPA that could potentially release contaminants to the source water. Maps showing the locations of the potential contaminant sources within the SWPA are included.
Susceptibility Analysis - This is an evaluation of the contaminant inventory to determine how likely it is that a potential contaminant source will affect a nearby drinking water source. Susceptibility is the combination of natural vulnerability of the water source to a potential impact and the physical and chemical properties of the potential contaminants.

The following tables list the source water assessments that have been developed in Horry, Georgetown, and Williamsburg Counties. A complete copy of each individual report can be accessed via: http://www.scdhec.gov/environment/water/srcewtrreports.htm

Table F1: Horry County Source Water Assessment Reports

System Name	Identification Number (#)	System Name	Identification Number (#)
Town of Aynor	No. 2610009	Merritt, Lora J.	No. 2670108
Bell Pontiac	No. 2670931	Midlands Elementary	No. 2670111
Bucksport Water Co.	No. 2620003	Midlands Grocery	No. 2670925
Budget Inn	No. 2670407	Mike Williamson MHP	No. 2660036
Christian Fellowship Academy	No. 2670146	City of Myrtle Beach (Groundwater Source)	No. 2610001
City of Conway	No. 2610008	City of Myrtle Beach (Surface Water Source)	No. 2610001
Conway Rural	No. 2620001	Myrtle West	No. 2670878
Daisy Elementary	No. 2670102	City of North Myrtle Beach	No. 2610011
EJ Country Kitchen	No. 2672006	Ocean Drive Lions Club	No. 2670914
FFA Camp	No. 2670676	Ocean Lakes Ltd.	No. 2660048
Finklea Career Center	No. 2670103	Pee Dee Farms Store	No. 2670916
Four Seasons Ice Company	No. 2630001	Pepsi Bottling	No. 2630002
Frys MHP	No. 2660052	Playcard Environmental	No. 2670916
Grace Christian School	No. 2670145	Pleasant View Trading Post	No. 2670946
Grand Strand WSA (Groundwater Source)	No. 2620004	Powells Tire and Axle	No. 2670941
Grand Strand WSA (Surface Water Source)	No. 2620004	Radd Dew BBQ	No. 2672005
Green Sea Floyd High School	No. 2670104	Razzle Dazzle Club	No. 2670927
Hardee Williams Mfg Co.	No. 2630008	Sandhills Links Inc.	No. 2670879
Horry County Public Safety	No. 2670936	Sugar Bears	No. 2670909
Horry County Admin Bldg	No. 2670918	The Wizard Golf Course	No. 2670933
Lakewood Campground	No. 2660049	Thompkins MHP	No. 2660045
Lay Fisher Chevy Olds	No. 2670929	TPC of Myrtle Beach LLC	No. 2670938
Little River W&SA	No. 2620002	WACC EOC Greensea Head	No. 2670138
Longwood Golf Corp.	No. 2670880	Waccamaw Economic Opportunity Council Inc.	No. 2670138
City of Loris	No. 2610010	Waccatee Zoo	No. 2670915
Man of War Golf Course	No. 2670921	Walker Variety and Auto	No. 2670924
Martins Grocery	No. 2670926		

Source: *SC Department of Health and Environmental Control, Source Water Protection Program*

Table F2: Georgetown County Source Water Assessment Reports	
System Name	Identification Number (#)
Town of Andrews	No. 2210003
BB Smith #3 Store	No. 2270912
Brown's Ferry WS	No. 2220003
Deep Creek Elementary	No. 2270106
GCWSD- Debordieu	No. 2250004
GCWSD- Garden City Point	No. 2220011
GCWSD- Kilsock Water	No. 2220002
GCWSD- North Santee	No. 2220012
GCWSD- Plantersville	No. 2220004
GCWSD- Red Hill	No. 2220007
GCWSD- Waccamaw Neck (Groundwater Source)	No. 2220010
GCWSD- Waccamaw Neck (Surface Water Source)	No. 2220010
GCWSD- Wedgefield Plantation	No. 2220006
GCWSD- Yauhannah	No. 2220013
City of Georgetown (Groundwater Source)	No. 2210001
City of Georgetown (Surface Water Source)	No. 2210001
Georgetown Mar Belle	No. 2270906
Georgetown Rural	No. 2220001
Highway 521 Mini Mart	No. 2270917
Hog Heaven Inc.	No. 2272003
International Paper- Sampit	No. 2230002
Peninsula at Inlet Point	No. 2250007
Pleasant Hill High School	No. 2270111
Pleasant Hill Middle School	No. 2270103
Rose Hill	No. 2220008
Wagon Wheel Farm	No. 2230801
Waterford Heights SD	No. 2250006
Source: *SC Department of Health and Environmental Control, Source Water Protection Program*	

Table F3: Williamsburg County Source Water Assessment Reports	
System Name	Identification Number (#)
Battery Park School	No. 4570100
Cades Hebron Elementary	No. 4570103
Coopers Country Store	No. 4570922
Coopers Quick Stop	No. 4570934
D P Cooper Elementary	No. 4570101
Fermpro	No. 4530001
Town of Greeleyville	No. 4510001
H & S Mingo Shop	No. 4570924
Town of Hemingway	No. 4510004
House of Raeford	No. 4530004
Kennys BBQ	No. 4572009
Town of Kingstree	No. 4510002
Town of Lane	No. 4510005
McKenzie's H Grocery Store	No. 4570937
M &M Country Store	No. 4570907
Morees BBQ	No. 4570203
Nesmith Community Day Care	No. 4570115
Nesmith Convenience Store	No. 4570911
Oceda Grocery	No. 4570917
Rock Bluff SD	No. 4550001
Santee Grocery	No. 4570931
Santee Sutton Mini Mart	No. 4570935
Scotts BBQ	No. 4572004
St. Mark School	No. 4570107
Town of Stuckey	No. 4510003
Trio Mini Mart	No. 4570909
Watfords Grocery	No. 4570932
WCSA Nesmith/ Morrisville	No. 4520001
WCSA South System	No. 4510007
Source: *SC Department of Health and Environmental Control, Source Water Protection Program*	

APPENDIX G- Groundwater Contamination Inventory

The majority of the identified groundwater contamination sites in the Waccamaw region are caused by leaking underground storage tanks. In fact 366 of the 412 groundwater contamination sites located in Horry, Georgetown, and Williamsburg Counties are from underground storage tanks. The tables below provide a brief description of each contamination site located in the Waccamaw region.

Risk-Based Corrective Action Priority Classification System for Underground Storage Tanks

UST sites are classified according to the following priority system. The inventory table includes the Classification for each UST site.

1. Sites are placed in Classification 1 if:

- An emergency situation exists
- A fire or explosion hazard exists
- Vapors or free product exists in a structure or utility
- Concentrations of petroleum chemicals of concern have been detected in a potable water supply or surface water supply intake
- Free product exists on surface water
- Petroleum chemicals of concern exist in surface water

2. Sites are placed in Classification 2 if:

Classification 2a:

- A significant near term (0 to 1 year) threat to human health, safety, or sensitive environmental receptors exists
- Potable supply wells or surface water supply intakes are located < 1 year groundwater travel distance downgradient of the source area

Classification 2b:

- Free product exists in a monitoring well measured at > 1 foot thickness
- Potable supply wells or surface water supply intakes are located < 1000 feet downgradient of the source area (where groundwater velocity data is not available)

3. Sites are placed in Classification 3 if:

Classification 3a:

- A short term (1 to 2 years) threat to human health, safety, or sensitive environmental receptors exists
- Potable supply wells or surface water supply intakes are located > 1 year and < 2 years groundwater travel distance downgradient of the source area
- Sensitive habitats or surface water exist < 1 year groundwater travel distance downgradient of the source area and the groundwater discharges to the sensitive habitat or surface water

Classification 3b:

- Free product exists in a monitoring well measured at > 0.01 foot thickness
- Concentrations of petroleum chemicals of concern are above the risk-based screening level (RBSL) have been detected in a non-potable water supply well
- Hydrocarbon-containing surface soil (< 3 feet below grade) exists in areas that are not paved
- Sensitive habitats or surface water used for contact recreation exist < 500 feet downgradient of the source area (where groundwater velocity and discharge location data are not available)
- The site is located in a sensitive hydrogeologic setting, determined based on the presence of fractured or carbonate bedrock hydraulically connected to the impacted aquifer
- Groundwater is encountered < 15 feet below grade and the site geology is predominantly sand or gravel

4. Sites are placed in Classification 4 if:

Classification 4a:

- A long term (> 2 years) threat to human health, safety, or sensitive environmental receptors exists
- Potable supply wells or surface water supply intakes are located > 2 years and < 5 years groundwater travel distance downgradient of the source area
- Non-potable supply wells area located < 1 year groundwater travel distance downgradient of the source area

Classification 4b:

- Free product exists as a sheen in any monitoring wells
- Non-potable supply wells are located < 1000 feet downgradient of the source water (where groundwater velocity data is not available)
- The groundwater is encountered < 15 feet and the site geology is predominantly silt or clay

5. Sites are placed in Classification 5 if:

- There is no demonstrable threat, but additional data are needed to show that there are no unacceptable risks posed by the site
- Assessment data for the site indicate concentrations in some samples are above the RBSL or site specific target level (SSTL), as appropriate, and further assessment is needed
- Assessment data for the site indicate concentrations in samples are below the RBSL or SSTL, as appropriate, but the samples are determined to not be representative; therefore, further assessment is needed

Table G1- 2008 Georgetown County Groundwater Contamination Inventory					
Contamination Incident	**Type of Contaminant**	**Source of Contamination**	**Site ID#**	**RBCA Classification for UST sites**	**Remarks**
51 Express	PETRO	UST	12199	3BA1	Conducting investigation/ Risk Assessment
Anderson Shell	PETRO	UST	03734	5B1	Conducting investigation/ Risk Assessment
Andrews Cleaners	VOC	S/L	EPA ID: SCD981751266 BLWM File # 52577	N/A	In assessment and monitoring phases
Andrews Section Shed	PETRO	UST	03631	3BF1	Conducting investigation/ Risk Assessment
Arcadia Plantation	PETRO	UST	03682	3BF6	Contacted
Atofina Chemicals, INC.	NO3	PPL	N/A	N/A	In monitoring phase
Baruch Foundation	PETRO	UST	13839	3BF6	Contacted
Beverage Depot	PETRO	UST	16780	3BC3	Monitored Natural Attenuation
Bippys Mart	PETRO	UST	03724	2BB3	Monitored Natural Attenuation
Bobby J Morris Grocery	PETRO	UST	15979	2BB4	Active corrective action
Brown Property- Pawleys	PETRO	UST	17347	3BF7	Approved Monitored Natural Attenuation
Captain Dicks Marina	PETRO	UST	14457	N/A	
Carrolls Service Station	PETRO	UST	14404	5A1	Conducting investigation/ Risk Assessment
Collins Grocery	PETRO	UST	09072	1D4	Active corrective action
Creel Oil Company	PETRO	AGT	N/A	N/A	Site is in assessment phase. Contaminants discharging to tributary of Sampit River
CSX Transportation Andrews	PETRO	UST	18351	3BF9	CNFA
CSX- Andrews	PETRO	UST, S/L	N/A	N/A	In monitoring phase
Currys Professional Dry Cleaners	VOC	S/L	EPA ID: SCD982087603 BLWM File#: 53015	N/A	In monitoring phase
D L Country Store	PETRO	UST	13997	1D1	Conducting investigation/ Risk Assessment
Deep Enterprise LLC	PETRO	UST	13113	3BF7	Approved Monitored Natural Attenuation
Doziers Grocery	PETRO	UST	14902	3BF1	Conducting investigation/ Risk Assessment
East Coast Fencing	PETRO	UST	19001	5A6	Contacted
Easy Pick Up 8	PETRO	UST	10767	3AA8	Awaiting funding
Edwards Grocery	PETRO	UST	09080	2AB4	Active corrective action
Five Points Amoco	PETRO	UST	15838	4BA1	Conducting investigation/ Risk Assessment
Flowers Service Station Inc.	PETRO	UST	03710	3AA5	Inactive
Food Pantry Super Chick	PETRO	UST	03727	2BB3	Monitored Natural Attenuation
Gas Plus	PETRO	UST	03714	2BA4	Active corrective action
Gasoline Alley	PETRO	UST	03740	3BE6	Contacted
Geo Specialty Chemicals (CYTEC)	OTHER	PPL	N/A	N/A	Sulfate. Monitored Natural Attenuation. Plume is discharging to Sampit River

Notes: Abbreviations include **PETRO**- Petroleum Products. **VOC-** Volatile Organic Compounds. **UST-** Underground Storage Tank. **S/L-** Spills/Leaks. **PPL-** Pits, Ponds, Lagoons. **AGT-** Above ground Storage Tank. **LF-** Landfill. **NO3-** Nitrates.
Source: *SC DHEC, 2008 South Carolina Groundwater Contamination Inventory.*

Table G1- 2008 Georgetown County Groundwater Contamination Inventory- Continued					
Contamination Incident	**Type of Contaminant**	**Source of Contamination**	**Site ID#**	**RBCA Classification for UST sites**	**Remarks**
Georgetown City of	PETRO	UST	09503	5A5	Inactive
Georgetown County Landfill	VOC	LF	Permit# 221001-1102	N/A	In monitoring phase
Georgetown County	PETRO	UST	13872	3BF1	Conducting investigation/ Risk Assessment
Georgetown Ice and Fuel	PETRO	UST	12493	2BA1	Conducting investigation/ Risk Assessment
Georgetown Laundry, Inc	VOC	S/L	EPA ID: SCD036152825 BLWM File#: 51144	N/A	In assessment and monitoring phases. Plume is discharging to Black River.
Georgetown Sunoco	PETRO	UST	03752	5B6	Contacted
Girdhar LLC	PETRO	UST	18597	2BB1	Conducting investigation/ Risk Assessment
Grier Grocery	PETRO	UST	09059	2BB7	Approved Monitored Natural Attenuation
H Floyd Miller and Sons	PETRO	UST	13106	2BB1	Conducting investigation/ Risk Assessment
Harbor Walk Marina	PETRO	UST	14463	2AA3	Monitored Natural Attenuation
Heritage Plantation	PETRO	UST	03656	3BF6	Contacted
Inlet Convenience and Fishing Slip	PETRO	UST	15780	2BB3	Monitored Natural Attenuation
Inlet Convenience Mart	PETRO	UST	03739	3BD8	Awaiting Funding
International Paper	METALS	LF	Permit #: 222435-1601	N/A	In monitoring phase. Industrial Solid Waste Landfill.
J Carter and Son	PETRO	UST	15461	3AC5	Inactive
Jacks Mini Mall	PETRO	UST	12402	1D1	Conducting investigation/ Risk Assessment
Jeanes Amoco and Deli	PETRO	UST	03697	3AC5	Inactive
Jessies Old Country Store	PETRO	UST	03674	3BD1	Conducting investigation/ Risk Assessment
Litchfield Hardware	PETRO	UST	03680	3BF7	Approved Monitored Natural Attenuation
Marlowes Grocery	PETRO	UST	03730	1D9	CNFA
Maryville Laundry Center	PETRO	UST	14330	3BF5	Inactive
Maryville Shell	PETRO	UST	03732	2AA4	Active Corrective Action
Mercers Welding Shop	PETRO	UST	17246	3BF8	Awaiting Funding
Mingo Exxon	PETRO	UST	03705	2BB3	Monitored Natural Attenuation
Money Saver	PETRO	UST	03696	2BB3	Monitored Natural Attenuation
Newtons General Store	PETRO	UST	03723	3BF1	Conducting investigation/ Risk Assessment
Oneita Industries	OTHER	S/L	N/A	N/A	Site is in monitoring phase for chloride
Pantry 3058 DBA Kangaroo Express	PETRO	UST	03757	5B1	Conducting investigation/ Risk Assessment
Pantry 3229	PETRO	UST	03713	1D4	Active Corrective Action
Pantry 409	PETRO	UST	03717	3BF9	CNFA
Pantry Inc	PETRO	UST	03755	3AA5	Inactive

Notes: Abbreviations include **PETRO**- Petroleum Products. **VOC-** Volatile Organic Compounds. **UST-** Underground Storage Tank. **S/L-** Spills/Leaks. **PPL-** Pits, Ponds, Lagoons. **AGT-** Above ground Storage Tank. **LF-** Landfill. **NO3-** Nitrates.
Source: *SC DHEC, 2008 South Carolina Groundwater Contamination Inventory.*

Table G1- 2008 Georgetown County Groundwater Contamination Inventory- Continued					
Contamination Incident	**Type of Contaminant**	**Source of Contamination**	**Site ID#**	**RBCA Classification for UST sites**	**Remarks**
Pawleys Island Express	PETRO	UST	03726	3BF7	Approved Monitored Natural Attenuation
Pawleys One Stop Shop	PETRO	UST	03728	2BB1	Conducting investigation/ Risk Assessment
Ronnies Service Center	PETRO	UST	10669	5B1	Conducting investigation/ Risk Assessment
Santee Cooper L.P. Substation	PETRO	S/L	N/A	N/A	Site is in remediation phase
Santee Cooper Winyah	PETRO	AGT	N/A	N/A	In monitoring, remediation and free product recovery phases. Two separate plumes.
SC667	PETRO	UST	03701	3BF5	Inactive
SC668	PETRO	UST	03700	3BF1	Conducting investigation/ Risk Assessment
SC696	PETRO	UST	03691	2BB6	Contacted
Scotchman 17	PETRO	UST	11824	2BB3	Monitored Natural Attenuation
Scotchman 50 Riverside Oil	PETRO	UST	11820	2BA1	Conducting investigation/ Risk Assessment
SCPSA Winyah Generating Station	PETRO	UST	03686	3BF1	Conducting investigation/ Risk Assessment
Service Station	PETRO	UST	15301	3BE1	Conducting investigation/ Risk Assessment
Simpson Lumber Co. Sampit Lumber Mill	PETRO	UST	03688	2BB6	Contacted
Smiths General Merchandise	PETRO	UST	12800	2BB3	Monitored Natural Attenuation
Sunoco 0607 9164 COOP2643	PETRO	UST	03706	2BA3	Monitored Natural Attenuation
Sunoco 0663-4109	PETRO	UST	03707	2BA1	Conducting investigation/ Risk Assessment
Sunoco 0695-5918/ COOP2642	PETRO	UST	03708	2AA4	Active corrective action
3V Chemical	PETRO, VOC	S/L	N/A	N/A	Site is in monitoring phase
Tindalls Grocery	PETRO	UST	13973	2BB3	Monitored Natural Attenuation
UST-Unknown 13982	PETRO	UST	13982	2BB3	Monitored Natural Attenuation
Value Mart	PETRO	UST	15288	2BB5	Inactive
Value Mart 1	PETRO	UST	16263	1D1	Conducting investigation/ Risk Assessment
Value Mart 2	PETRO	UST	03746	3BF1	Conducting investigation/ Risk Assessment
Wachovia Bank	PETRO	UST	17802	3BF8	Awaiting Funding
Weaver and Sons Restaurant	PETRO	UST	18685	2BB6	Contacted
Wilco Fuel Plaza 946	PETRO	UST	17901	2BB1	Conducting investigation/ Risk Assessment
Winyah Concrete & Block Co. Inc.	PETRO	UST	03663	3BF3	Monitored Natural Attenuation

Notes: Abbreviations include **PETRO**- Petroleum Products. **VOC-** Volatile Organic Compounds. **UST-** Underground Storage Tank. **S/L-** Spills/Leaks. **PPL-** Pits, Ponds, Lagoons. **AGT-** Above ground Storage Tank. **LF-** Landfill. **NO3-** Nitrates.
Source: *SC DHEC, 2008 South Carolina Groundwater Contamination Inventory.*

Table G2- 2008 Horry County Groundwater Contamination Inventory

Contamination Incident	Type of Contaminant	Source of Contamination	Site ID#	RBCA Classification for UST sites	Remarks
501 Amoco	PETRO	UST	05156	3BF1	Conducting investigation/ Risk Assessment
501 BP	PETRO	UST	05175	3AA8	Awaiting Funding
501 Entry Park	PETRO	UST	05098	3BF5	Inactive
501 Mini Mart LLC	PETRO	UST	10309	2BB1	Conducting investigation/ Risk Assessment
501 Shell	PETRO	UST	05026	4BC1	Conducting investigation/ Risk Assessment
Amit Patel LLC	PETRO	UST	05165	3BF1	Conducting investigation/ Risk Assessment
AVX- American Gear & Pinion Co.	VOC	PPL	EPA ID: SCD980078554 BLWM File# 52077	N/A	In monitoring and remediation phases
AVX Corporation Myrtle Beach	VOC	UST, S/L	EPA ID: SCD062690557 BLWM File# 51602	N/A	In assessment and remediation phases. Plume discharging to Withers Swash. No discovered impact to drinking water wells. However, several irrigation wells in residential areas impacted.
Aynor Food and Gas	PETRO	UST	05153	2AA8	Awaiting Funding
Aynor Section Shed	PETRO	UST	05080	3BF4	Active Corrective Action
B&B Convenience Store	PETRO	UST	04940	2BB8	Awaiting Funding
B&B Superette	PETRO	UST	05220	3BF5	Inactive
B&M Tire Service	PETRO	UST	16134	3AA8	Awaiting Funding
Badger R Bazen Co. Inc.	PETRO	UST	13249	4BC6	Contacted
Barkers 76	PETRO	UST	05160	2AA1	Conducting investigation/ Risk Assessment
Bayboro Clover Farm	PETRO	UST	04942	3BF5	Inactive
Baytree Exxon	PETRO	UST	04975	3BF4	Active Corrective Action
Beach Buffers of 52nd Ave.	PETRO	UST	05179	2BB3	Monitored Natural Attenuation
Bell Oil Co.	PETRO	UST	13901	3BA6	Contacted
Bells Station Kings Garage	PETRO	UST	14130	2BB1	Conducting investigation/ Risk Assessment
Best Golf Carts/ Dumpwood Preservation	METALS	S/L	EPA ID: SCD987570637 BLWM File# 53879	N/A	In monitoring and remediation phases. Plume is discharging to Brown Swamp
Better Brands Inc	PETRO	UST	05031	3AC8	Awaiting Funding
Bob Bible Honda/BMW	PETRO	UST	05219	3BE6	Contacted
Bobby Gale Chrysler/Dodge/ Jeep	PETRO	UST	N/A	N/A	Site is in assessment phase
Boosalis Property	PETRO	UST	18301	2BB9	CNFA
Brants Landing	PETRO	UST	04962	1C4	Active Corrective Action
Brave Village Shopping Center	PETRO	UST	16899	2BB3	Monitored Natural Attenuation
Britts 66	PETRO	UST	04976	2BA1	Conducting investigation/ Risk Assessment
Bruces Handy Mart	PETRO	UST	14233	3BF6	Contacted
Buckwood Shell	PETRO	UST	12362	3BF7	Approved Monitored Natural Attenuation
Buffkin Service Center	PETRO	UST	05237	3BF&	Approved Monitored Natural Attenuation
Bulk Shell Station	PETRO	AGT	N/A	N/A	In assessment phase
Bull Mart 2	PETRO	UST	11005	2BA4	Active Corrective Action
Burning Ridge Golf Course	PETRO	UST	15477	3BF6	Contacted
C&C Handy Mart	PETRO	UST	05186	2BB1	Conducting investigation/ Risk Assessment
Carmichael's Exxon	PETRO	UST	05100	2BB5	Inactive

Notes: Abbreviations include **PETRO-** Petroleum Products. **VOC-** Volatile Organic Compounds. **UST-** Underground Storage Tank. **S/L-** Spills/Leaks. **PPL-** Pits, Ponds, Lagoons. **AGT-** Above ground Storage Tank. **UPD-** Unpermitted Discharge. **BNA-** Base, Neutral, and Acid Extractables.
Source: *SC DHEC, 2008 South Carolina Groundwater Contamination Inventory.*

Table G2- 2008 Horry County Groundwater Contamination Inventory- Continued

Contamination Incident	Type of Contaminant	Source of Contamination	Site ID#	RBCA Classification for UST sites	Remarks
Carolina Country Cooker	PETRO	UST	19290	2BB1	Conducting investigation/ Risk Assessment
Carolina Discount	PETRO	UST	04965	3BF6	Contacted
Carriage Row Pump Station	PETRO	UST	14965	3AA7	Approved Monitored Natural Attenuation
Carris R Cribb Site	PETRO	UST	16574	3BF1	Conducting investigation/ Risk Assessment
Cash & Dash	PETRO	UST	12901	5A1	Conducting investigation/ Risk Assessment
Chapin Service Station	PETRO	UST	05137	3BF3	Monitored Natural Attenuation
Chavis Van and Storage	PETRO	UST	05172	3BD3	Monitored Natural Attenuation
Chep Skis Deli	PETRO	UST	18177	3BF6	Contacted
Chris Yahnis Coastal Inc.	PETRO	UST	10982	3BF8	Awaiting Funding
Circle K 2708105	PETRO	UST	05112	3BF1	Conducting investigation/ Risk Assessment
Circle K 2708109	PETRO	UST	05182	2BB8	Awaiting Funding
Circle K 8087	PETRO	UST	05167	2BB3	Monitored Natural Attenuation
Circle K 8112	PETRO	UST	05183	3BF1	Conducting investigation/ Risk Assessment
Coastal Savers	PETRO	UST	12399	3BA8	Awaiting Funding
Cool Springs Farm Center	PETRO	UST	04956	2BB8	Awaiting Funding
Crabtree Crossings	PETRO	UST	17430	3BA1	Conducting investigation/ Risk Assessment
Crafts and Stuff	PETRO	UST	04978	3BD1	Conducting investigation/ Risk Assessment
Creel Oil Company	PETRO	S/L, AGT	N/A	N/A	In assessment phase. Free product discharging to drainage ditch.
Crescent Beach Citgo	PETRO	UST	05116	2BB4	Active Corrective Action
Crescent Beach Exxon	PETRO	UST	11199	2BB3	Monitored Natural Attenuation
Cypress Park Mart	PETRO	UST	05234	4BC7	Approved Monitored Natural Attenuation
Dargan Construction Co. Inc.	PETRO	UST	14425	3BF8	Awaiting Funding
Derwoods	PETRO	UST	05143	3BF7	Inactive
Dhiels Handy Mart	PETRO	UST	05221	N/A	Approved Monitored Natural Attenuation
Dilmar Oil (Conway Bulk Plant)	PETRO	AGT	N/A	3BF8	In remediation phase
Easy Pick Up 1	PETRO	UST	05177	5B8	Awaiting Funding
Edge manufacturing Co. Inc.	PETRO	UST	15059	2BA8	Awaiting Funding
Elvis General Repair	PETRO	UST	04946	3BF8	Awaiting Funding
Emory Express	PETRO	UST	15241	5B8	Awaiting Funding
Estate of Mary E Holt	PETRO	UST	18782	2BB1	Conducting investigation/ Risk Assessment
Fleet Operations Building	PETRO	UST	11180	3AA7	Approved Monitored Natural Attenuation
Food Chief 20	PETRO	UST	05233	3BA8	Awaiting Funding
Food Depot	PETRO	UST	12540	2BA1	Conducting investigation/ Risk Assessment
Food Shoppe	PETRO	UST	10327	3AA1	Conducting investigation/ Risk Assessment
Ford's Fuel Oil	PETRO	AGT	N/A	N/A	Site is in negotiation for Groundwater Mixing Zone
Former Conway Maintenance FAC	PETRO	UST	05076	3BD3	Monitored Natural Attenuation

Notes: Abbreviations include **PETRO-** Petroleum Products. **VOC-** Volatile Organic Compounds. **UST-** Underground Storage Tank. **S/L-** Spills/Leaks. **PPL-** Pits, Ponds, Lagoons. **AGT-** Above ground Storage Tank. **UPD-** Unpermitted Discharge. **BNA-** Base, Neutral, and Acid Extractables.

Source: *SC DHEC, 2008 South Carolina Groundwater Contamination Inventory.*

Table G2- 2008 Horry County Groundwater Contamination Inventory- Continued					
Contamination Incident	**Type of Contaminant**	**Source of Contamination**	**Site ID#**	**RBCA Classification for UST sites**	**Remarks**
Former Green Sea Section Shed	PETRO	UST	05075	2BB3	Monitored Natural Attenuation
Former Krispy Kreme	PETRO	UST	19367	5B1	Conducting investigation/ Risk Assessment
Former Twilight Station (Pantry 3150)	PETRO	UST	04974	3BF1	Conducting investigation/ Risk Assessment
Four Points	PETRO	UST	04953	3BF1	Conducting investigation/ Risk Assessment
Fowler Motors Inc	PETRO	UST	05045	3BD3	Monitored Natural Attenuation
Fowlers Grocery &Variety	PETRO	UST	05009	2BB7	Approved Monitored Natural Attenuation
G&T Discount Center	PETRO	UST	13054	3BF7	Approved Monitored Natural Attenuation
Galaxy Video	PETRO	UST	18594	3BF7	Approved Monitored Natural Attenuation
Garden City 66	PETRO	UST	04987	2BB3	Monitored Natural Attenuation
Gateway Homes	PETRO	UST	15062	1D4	Active Corrective Action
General Telephone of the South	PETRO	UST	05025	3BF1	Conducting investigation/ Risk Assessment
Geralds Conv. Store and Grill	PETRO	UST	11570	2BB8	Awaiting Funding
Graingers Red & White	PETRO	UST	04957	2AB4	Active Corrective Action
Grand Strand Air Service	PETRO	UST	05035	3BF1	Conducting investigation/ Risk Assessment
Green Sea Grocery	PETRO	UST	05194	2AB4	Active Corrective Action
Hadwin White Pontiac Buick	PETRO	UST	05196	4BC1	Conducting investigation/ Risk Assessment
Harrys Auto Parts and Wrecker	PETRO	UST	12778	2BB8	Awaiting Funding
Homewood Depot	PETRO	UST	15403	2BB4	Active Corrective Action
Horry School Bus Shop	PETRO	UST	04929	3BA7	Approved Monitored Natural Attenuation
Hot Spot 2024	PETRO	UST	12749	2BB8	Awaiting Funding
Hucks Country Express	PETRO	UST	11560	1C4	Active Corrective Action
Jack Hooks General Store West	PETRO	UST	14508	2BB8	Awaiting Funding
Jack Hooks General Store East	PETRO	UST	18231	2BB8	Awaiting Funding
Jerry Cox Co.	PETRO	UST	05119	3BF8	Awaiting Funding
Jerry Cox Co.	PETRO	UST	05120	2BA8	Awaiting Funding
Jiffy Shop	PETRO	UST	04988	2BB7	Approved Monitored Natural Attenuation
Joan Elliott Site	PETRO	UST	15145	2BB1	Conducting investigation/ Risk Assessment
Joes Grocery and Hardware	PETRO	UST	14395	1D4	Active Corrective Action
Johns Automotive	PETRO	UST	12604	2BB8	Awaiting Funding
Johnsons Superette	PETRO	UST	14017	2BB3	Monitored Natural Attenuation
Jordanville Farm Supply	PETRO	UST	04945	2AB1	Conducting investigation/ Risk Assessment
JR's Convenience Mart	PETRO	UST	12753	2AB4	Active Corrective Action
King Property	PETRO	UST	14821	3BF5	Inactive
KNH Food Mart	PETRO	UST	14202	2AA4	Active Corrective Action
Lee's Convenience	PETRO	UST	05188	2BB1	Conducting investigation/ Risk Assessment
Lee's Discount Center	PETRO	UST	05213	3BF8	Awaiting Funding

Notes: Abbreviations include **PETRO-** Petroleum Products. **VOC-** Volatile Organic Compounds. **UST-** Underground Storage Tank. **S/L-** Spills/Leaks. **PPL-** Pits, Ponds, Lagoons. **AGT-** Above ground Storage Tank. **UPD-** Unpermitted Discharge. **BNA-** Base, Neutral, and Acid Extractables.

Source: *SC DHEC, 2008 South Carolina Groundwater Contamination Inventory.*

Table G2- 2008 Horry County Groundwater Contamination Inventory- Continued					
Contamination Incident	**Type of Contaminant**	**Source of Contamination**	**Site ID#**	**RBCA Classification for UST sites**	**Remarks**
Liberty Car Wash	PETRO	UST	15335	3BF1	Conducting investigation/ Risk Assessment
Lillians	PETRO	UST	05145	3BA8	Awaiting Funding
Little River Gulf-BP	PETRO	UST	05178	2BB8	Awaiting Funding
Live Oak Grocery	PETRO	UST	04972	2BB7	Approved Monitored Natural Attenuation
Longs Section Shed	PETRO	UST	05078	3AB1	Conducting investigation/ Risk Assessment
Loris Ford Inc	PETRO	UST	12698	2BB8	Awaiting Funding
Loris Section Shed	PETRO	UST	05077	3BC3	Monitored Natural Attenuation
Low Country Wholesale Tire	PETRO	UST	12699	3BF8	Awaiting Funding
Main St. Shell	PETRO	UST	05027	1B4	Active Corrective Action
MBAFB BLDG 324	VOC	S/L, UST	EPA ID: SC7570024821	N/A	SWMU 40. In remediation phase; groundwater extraction turned off. OPS determination issued by EPA and DHEC.
MBAFB BLDG 505	VOC	S/L	EPA ID: SC7570024821	N/A	SWMUs 79 & 80. In remediation phase. One groundwater extraction well currently operating.
MBAFB Building 575, Munitions Facility	VOC	S/L	EPA ID: SC7570024821	N/A	SWMU256. Chlorinated VOCs have rebounded. Additional remediation planned (chemical oxidation and groundwater extraction).
MBAFB Fire Training Area 11	VOC	S/L	EPA ID: SC7570024821	N/A	SWMU 11. Chemical oxidation and groundwater extraction proceeding. LUCs under review.
MBAFB Fire Training Area FT-16 and AOC FOLTA	PETRO, VOC, METALS	UPD, S/L	EPA ID: SC7570024821	N/A	In monitoring phase. SWMU 12-14, SWMU 255.
MBAFB Fire Training Areas 6 and 7	PETRO	UPD, S/L	EPA ID: SC7570024821	N/A	SWMUs 9 and 10. Investigation complete. ORC injection complete. Currently in final phase of monitoring.
MBAFB Mogas Tank	PETRO	UST	13556	1D4	Active corrective action.
MBAFB Old Entomology Shop	PETRO, VOC	AGT, S/L, UST	EPA ID: SC7570024821	N/A	Offbase groundwater plume. Groundwater pump and treatment system currently installed and running.
MBAFB Pol Yard	PETRO, VOC	AGT, S/L, UST	EPA ID: SC7570024821	N/A	Site has obtained OPS.
MBAFB Vehicle Maintenance Area	PETRO, VOC	S/L	EPA ID: SC7570024821	N/A	Investigation complete. CMI WP Addendum to be submitted soon.
MBAFB Weathering Pit (WP-08)	PETRO, VOC	UPD, S/L	EPA ID: SC7570024821	N/A	CMI WP Addendum to be submitted soon.
MBAFB/ BLDG. 122 (ST-26)(SWMU-138)	PETRO	UST	N/A	N/A	In remediation phase
MBAFB/MB Pipeline Co. (SS-02)	PETRO	AGT	N/A	N/A	In remediation phase
MBAFB/ Pol Yard (SWMU81)(SS-03)	PETRO	S/L, AGT	N/A	N/A	In remediation phase. Contaminants discharging to unnamed drainage feature.
Midway Chapel	PETRO	UST	17558	2BB9	CNFA
Miss Kitty Inc.	PETRO	UST	15532	3BF7	Approved Monitored Natural Attenuation
Money Saver Food Mart	PETRO	UST	04958	2BB1	Conducting investigation/ Risk Assessment
Morris Graham	PETRO	UST	14111	3BF6	Contacted
Mr. G's Food Store 128	PETRO	UST	04960	2BB4	Active Corrective Action
Mr. Neon	PETRO	UST	15677	2BB8	Awaiting Funding

Notes: Abbreviations include **PETRO-** Petroleum Products. **VOC-** Volatile Organic Compounds. **UST-** Underground Storage Tank. **S/L**- Spills/Leaks. **PPL-** Pits, Ponds, Lagoons. **AGT-** Above ground Storage Tank. **UPD-** Unpermitted Discharge. **BNA-** Base, Neutral, and Acid Extractables.
Source: *SC DHEC, 2008 South Carolina Groundwater Contamination Inventory.*

Table G2- 2008 Horry County Groundwater Contamination Inventory- Continued					
Contamination Incident	**Type of Contaminant**	**Source of Contamination**	**Site ID#**	**RBCA Classification for UST sites**	**Remarks**
Mt. Olive Grocery	PETRO	UST	05001	2BB1	Conducting investigation/ Risk Assessment
Murphy USA 5731	PETRO	UST	18451	3BA1	Conducting investigation/ Risk Assessment
Myrtle Beach Grand Prix	PETRO	UST	14131	3BD1	Conducting investigation/ Risk Assessment
Myrtle Beach Section Shed	PETRO	UST	05079	3BF4	Active Corrective Action
Myrtle Cinema 10 Property	PETRO	UST	18410	3BF1	Conducting investigation/ Risk Assessment
Myrtlewood Golf Course (Pines)	PETRO	UST	05048	2BA8	Awaiting Funding
New South Companies-Conway	METALS	S/L	N/A	N/A	Site is in assessment phase
Norris Cash Store	PETRO	UST	16272	3BD7	Approved Monitored Natural Attenuation
North Myrtle Beach Airport	PETRO	AGT	N/A	N/A	Site is in assessment phase. Jet-A
Northside Texaco	PETRO	UST	05225	3BF5	Inactive
Ocean Dunes & Sand Dunes Resort	PETRO	UST	16677	3BD7	Approved Monitored Natural Attenuation
Ocean Lakes Service Corp	PETRO	UST	05144	2BB8	Awaiting Funding
Old Hardwicks Grocery	PETRO	UST	15098	2BB8	Awaiting Funding
Pams Corner Inc.	PETRO	UST	05158	3BD8	Awaiting Funding
Pantry 291	PETRO	UST	05200	3BF8	Awaiting Funding
Pantry 3059 DBA Quick Stop	PETRO	UST	05124	2BA4	Active Corrective Action
Pantry 3060 DBA Quick Stop	PETRO	UST	10148	3BF8	Awaiting Funding
Pantry 3062 DBA Kangaroo	PETRO	UST	05122	3BF3	Monitored Natural Attenuation
Pantry 3063 DBA Kangaroo	PETRO	UST	10145	2AA4	Active Corrective Action
Pantry 3064	PETRO	UST	05104	3AC8	Awaiting Funding
Pantry 3065	PETRO	UST	05114	3BF8	Awaiting Funding
Pantry 3066 DBA Kangaroo Express	PETRO	UST	05115	3BD1	Conducting investigation/ Risk Assessment
Pantry 3140 DBA Kangaroo	PETRO	UST	04993	3BF8	Awaiting Funding
Pantry 3220 DBA Kangaroo	PETRO	UST	09956	3BF8	Awaiting Funding
Pantry 3221 DBA Kangaroo	PETRO	UST	09957	4BC8	Awaiting Funding
Pantry 3224	BNA	UST	05230	3BA1	Conducting investigation/ Risk Assessment
Pantry 3225 DBA Kangaroo	PETRO	UST	05229	3BF8	Awaiting Funding
Pantry 3226 DBA Food Chief	PETRO	UST	05232	3BF3	Monitored Natural Attenuation
Pantry 3228 DBA Kangaroo	PETRO	UST	05231	3BF5	Inactive
Pantry 3418	PETRO	UST	05042	2BB1	Conducting investigation/ Risk Assessment
Pantry 3482 DBA TH' Store	PETRO	UST	05240	3BF1	Conducting investigation/ Risk Assessment

Notes: Abbreviations include **PETRO-** Petroleum Products. **VOC-** Volatile Organic Compounds. **UST-** Underground Storage Tank. **S/L-** Spills/Leaks. **PPL-** Pits, Ponds, Lagoons. **AGT-** Above ground Storage Tank. **UPD-** Unpermitted Discharge. **BNA-** Base, Neutral, and Acid Extractables.

Source: *SC DHEC, 2008 South Carolina Groundwater Contamination Inventory.*

Table G2- 2008 Horry County Groundwater Contamination Inventory- Continued					
Contamination Incident	Type of Contaminant	Source of Contamination	Site ID#	RBCA Classification for UST sites	Remarks
Pantry 3484 DBA Kangaroo	PETRO	UST	12951	3BF8	Awaiting Funding
Pantry 3490 DBA Kangaroo	PETRO	UST	18648	3BA1	Conducting investigation/ Risk Assessment
Pantry 431	PETRO	UST	05212	2BA1	Conducting investigation/ Risk Assessment
Pantry 465	PETRO	UST	05209	3BF1	Conducting investigation/ Risk Assessment
Parkers Auto & Truck Service	PETRO	UST	18618	5A1	Conducting investigation/ Risk Assessment
Patel Brothers DBA Pavilion Discount Beverage	PETRO	UST	05096	3BF6	Contacted
Pee Dee Conv.	PETRO	UST	10344	3BE8	Awaiting Funding
Pee Dee Stores Inc.	PETRO	UST	12930	2BB8	Awaiting Funding
Pepsi Cola Bottling Co. of Conway	PETRO	UST	05052	3BF8	Awaiting Funding
Pit Stop Car Washes Inc.	PETRO	UST	05117	3BF5	Inactive
Port Unit 205	PETRO	UST	05185	1D4	Active Corrective Action
PYA Monarch Inc.	PETRO	UST	05030	2AA4	Active Corrective Action
Quick Stop 1	PETRO	UST	05155	3BD5	Inactive
Quickie Foods	PETRO	UST	04954	3BF3	Monitored Natural Attenuation
R W Wood General Merchandise	PETRO	UST	12982	1D4	Active Corrective Action
Red Hill Station	PETRO	UST	04896	3BF1	Conducting investigation/ Risk Assessment
Reliance Petroleum	PETRO	UST	12052	2BB8	Awaiting Funding
Rental Service Corp Store 615	PETRO	UST	05012	3AC4	Active Corrective Action
Rivertown Amoco	PETRO	UST	05192	4AA3	Monitored Natural Attenuation
S Strand Customer Service Complex	PETRO	UST	10811	3BC8	Awaiting Funding
Sailing and Ski Connection	PETRO	UST	15213	5A1	Conducting investigation/ Risk Assessment
Sams Handy Mart	PETRO	UST	05187	1C4	Active Corrective Action
Santee Cooper Grainger Station	PETRO, METALS	PPL, AGT	N/A	N/A	In remediation phase
Sav Way 21	PETRO	UST	05190	N/A	inactive
Savings Sta & Dodges Store	PETRO	UST	05764	2BB8	Awaiting Funding
SC Dept of Transportation Conway	PETRO	UST	10215	3BD8	Awaiting Funding
SC651	PETRO	UST	05180	3BF5	inactive
Scotchman 106	PETRO	UST	05163	2BB3	Monitored Natural Attenuation
Scotchman 118	PETRO	UST	05161	3AC3	Monitored Natural Attenuation
Scotchman 124	PETRO	UST	10101	3BF5	Inactive
Scotchman 133	PETRO	UST	10288	3BF4	Active Corrective Action
Scotchman 137	PETRO	UST	11823	3BF8	Awaiting Funding
Scotchman 146	PETRO	UST	10758	3BF8	Awaiting Funding
Scotchman 179	PETRO	UST	12649	3AC1	Conducting investigation/ Risk Assessment
Scotchman 18	PETRO	UST	04952	3BF5	Inactive
Scotchman 221	PETRO	UST	18679	5B1	Conducting investigation/ Risk Assessment
Scotchman 25	PETRO	UST	04951	1C6	Contacted
Scotchman 252	PETRO	UST	05162	3BA1	Conducting investigation/ Risk Assessment

Notes: Abbreviations include **PETRO-** Petroleum Products. **VOC-** Volatile Organic Compounds. **UST-** Underground Storage Tank. **S/L-** Spills/Leaks. **PPL-** Pits, Ponds, Lagoons. **AGT-** Above ground Storage Tank. **UPD-** Unpermitted Discharge. **BNA-** Base, Neutral, and Acid Extractables.

Source: *SC DHEC, 2008 South Carolina Groundwater Contamination Inventory.*

Table G2- 2008 Horry County Groundwater Contamination Inventory- Continued					
Contamination Incident	**Type of Contaminant**	**Source of Contamination**	**Site ID#**	**RBCA Classification for UST sites**	**Remarks**
Scotchman 253	PETRO	UST	05142	3BF5	Inactive
Scotchman 29	PETRO	UST	04950	3BF8	Awaiting Funding
Scotchman 31	PETRO	UST	04949	3BF8	Awaiting Funding
Scotchman 43	PETRO	UST	05148	3BD1	Conducting investigation/ Risk Assessment
Scotchman 48	PETRO	UST	04963	2BB8	Awaiting Funding
Scotchman 52	PETRO	UST	05147	3BF1	Conducting investigation/ Risk Assessment
Scotchman 58	PETRO	UST	05138	3BA1	Conducting investigation/ Risk Assessment
Scotchman 6	PETRO	UST	05154	3BA1	Conducting investigation/ Risk Assessment
Scotchman 60	PETRO	UST	04961	3AC4	Active Corrective Action
Scotchman 64	PETRO	UST	05140	3BA8	Awaiting Funding
Scotchman 69	PETRO	UST	05166	3AC8	Awaiting Funding
SCPSA Grainger Generating Station	PETRO	UST	15023	3AC8	Awaiting Funding
Seaboard Petroleum	PETRO	UST	10682	3AC1	Conducting investigation/ Risk Assessment
Service America	PETRO	UST	17274	3BF3	Monitored Natural Attenuation
Sharkeys Discount Beverage	PETRO	UST	10476	3BF8	Awaiting Funding
Shortys Place	PETRO	UST	15980	2BB5	Inactive
Sky Signs	PETRO	AGT	N/A	N/A	Site is in assessment phase
Socastee Seafood Shak	PETRO	UST	18533	5B1	Conducting investigation/ Risk Assessment
Stricklands Grocery	PETRO	UST	15530	2BB8	Awaiting Funding
Sunhouse Petroleum #11	PETRO	UST	10355	3BF1	Conducting investigation/ Risk Assessment
Sunhouse Petroleum 2	PETRO	UST	14850	2BB1	Conducting investigation/ Risk Assessment
Sunhouse Petroleum LLC	PETRO	UST	05169	3BF6	Contacted
Sunhouse Petroleum #10	PETRO	UST	04939	3BF1	Conducting investigation/ Risk Assessment
Sunset Grocery	PETRO	UST	14608	2BB7	Approved Monitored Natural Attenuation
Sunshine Convenience Mart	PETRO	UST	10932	3BC6	Contacted
Sunspot Convenience and Deli	PETRO	UST	05205	3BD9	CNFA
Sureway Grocery	PETRO	UST	10583	1D1	Conducting investigation/ Risk Assessment
Surfside Beach Town Of	PETRO	UST	14237	5B1	Conducting investigation/ Risk Assessment
TJ Party Shop	PETRO	UST	13781	3DF8	Awaiting Funding
Tea Off Deli of Myrtle Beach	PETRO	UST	10554	5B1	Conducting investigation/ Risk Assessment
Third Base Lounge	PETRO	UST	16798	3BF1	Conducting investigation/ Risk Assessment
Tiger Mart 10	PETRO	UST	11101	3BF5	Inactive
Tiger Mart 11	PETRO	UST	10902	3AA8	Awaiting Funding
Tiger Mart 14	PETRO	UST	05170	3BA8	Awaiting Funding
Tiger Mart 15	PETRO	UST	05101	3BD8	Awaiting Funding
Tiger Mart 16	PETRO	UST	05095	3BD5	Inactive
Tiger Mart 3	PETRO	UST	05110	3BA1	Conducting investigation/ Risk Assessment

Notes: Abbreviations include **PETRO**- Petroleum Products. **VOC-** Volatile Organic Compounds. **UST-** Underground Storage Tank. **S/L-** Spills/Leaks. **PPL-** Pits, Ponds, Lagoons. **AGT-** Above ground Storage Tank. **UPD-** Unpermitted Discharge. **BNA-** Base, Neutral, and Acid Extractables.

Source: *SC DHEC, 2008 South Carolina Groundwater Contamination Inventory.*

Table G2- 2008 Horry County Groundwater Contamination Inventory- Continued					
Contamination Incident	**Type of Contaminant**	**Source of Contamination**	**Site ID#**	**RBCA Classification for UST sites**	**Remarks**
Tiger Mart 9	PETRO	UST	11598	3BA1	Conducting investigation/ Risk Assessment
Tilly Swamp Handimart	PETRO	UST	04964	2BB4	Active Corrective Action
Time Saver 9	PETRO	UST	05017	2BB7	Approved Monitored Natural Attenuation
Tire Super Market	PETRO	UST	18994	3BF5	Inactive
Todos Country Corner	PETRO	UST	15529	3BC1	Conducting investigation/ Risk Assessment
Tylers Convenience & Grill	PETRO	UST	05139	3BA1	Conducting investigation/ Risk Assessment
UST-Unknown 18718	PETRO	UST	18718	2BB1	Conducting investigation/ Risk Assessment
Vereens Thriftway	PETRO	UST	11198	3BF8	Awaiting Funding
Video World	PETRO	UST	09664	3AC2	Free Product Recovery Only
Village Hardware	PETRO	UST	14367	3BD8	Awaiting Funding
WG Turbeville Grocery	PETRO	UST	15803	3BF1	Conducting investigation/ Risk Assessment
Wailons Quick Stop	PETRO	UST	12814	2BB8	Awaiting Funding
Watsons Grocerette	PETRO	UST	19276	3AC8	Awaiting Funding
Watts Produce	PETRO	UST	14053	3BF1	Conducting investigation/ Risk Assessment
Wolverine Brass INC.	VOC, METALS	PPL, OTHER	N/A	N/A	In remediation phase. A corrective measures study has been imposed for the Industrial Sewer Pipeline.

Notes: Abbreviations include **PETRO-** Petroleum Products. **VOC-** Volatile Organic Compounds. **UST-** Underground Storage Tank. **S/L-** Spills/Leaks. **PPL-** Pits, Ponds, Lagoons. **AGT-** Above ground Storage Tank. **UPD-** Unpermitted Discharge. **BNA-** Base, Neutral, and Acid Extractables.

Source: *SC DHEC, 2008 South Carolina Groundwater Contamination Inventory.*

Table G3- 2008 Williamsburg County Groundwater Contamination Inventory					
Contamination Incident	**Type of Contaminant**	**Source of Contamination**	**Site ID#**	**RBCA Classification for UST sites**	**Remarks**
Anglers Mini Mart	PETRO	UST	09096	3BB1	Conducting investigation/ Risk Assessment
B&H Grocery	PETRO	UST	03754	2BB1	Conducting investigation/ Risk Assessment
Bydrics Texaco	PETRO	UST	09114	3BC5	Inactive
Calcutus Grocery	PETRO	UST	09120	2AA4	Active corrective action
Carolina Express	PETRO	UST	09102	1D4	Active corrective action
Carroll Lane	PETRO	UST	09123	2AA6	Contacted
China's Grocery	PETRO	UST	09078	2BB1	Conducting investigation/ Risk Assessment
Coopers Grocery	PETRO	UST	15828	2BA1	Conducting investigation/ Risk Assessment
Cox Feed and Seed	PETRO	UST	18107	2BB9	CNFA
Coxs Meat Co.	PETRO	UST	11525	3BF1	Conducting investigation/ Risk Assessment
DJ's Express	PETRO	UST	09143	2BA5	Inactive
Eaddy Brothers	PETRO	UST	13850	1A4	Active corrective action
Ellco Bulk Fuel Site	PETRO	AGT	N/A	N/A	Site is in remediation phase. Public supply well is located within 1000ft of site. Sampled ok in August 2000.
F W Thomas Car Wash	PETRO	UST	09052	3BF5	Inactive
Fast Point 48	PETRO	UST	09131	3BA5	Inactive
Former Kingstree Maint Facility	PETRO	UST	09020	2BA5	Inactive
Grandma's Grocery	PETRO	UST	09053	3AB9	CNFA
Greeleyville Service Center	PETRO	UST	12835	2BB1	Conducting investigation/ Risk Assessment
Grier Home Center	PETRO	UST	14455	2BB8	Awaiting Funding
Hemingway Town of	PETRO	UST	11562	3BF1	Conducting investigation/ Risk Assessment
Herbs Quick Shop Inc.	PETRO	UST	09139	3BF8	Awaiting Funding
J&J Grocery	PETRO	UST	09088	2BB8	Awaiting Funding
Kenny's Express	PETRO	UST	09128	3BD8	Awaiting Funding
Martek Industrial Landfill	NO3	UNK	Permit# 453349-1601, 453305-1601	N/A	In monitoring phase. Concentrations of nitrate in upgradient well showed that contamination is likely from a pasture upgradient of the landfill.
McCutcheons Grocery	PETRO	UST	09125	2BB1	Conducting investigation/ Risk Assessment
McFarlin Superette	PETRO	UST	09108	2BB1	Conducting investigation/ Risk Assessment
McLeans Country Store	PETRO	UST	09076	2AB1	Conducting investigation/ Risk Assessment
Nathene Williamson	PETRO	UST	09066	2BB7	Approved Monitored Natural Attenuation
Nesmith Well Contamination	PETRO	UST	15971	1D4	Active corrective action
North Kingstree Shell	PETRO	UST	09099	5B1	Conducting investigation/ Risk Assessment
One Stop	PETRO	UST	18108	2BB9	CNFA
O'Neals Gro	PETRO	UST	09070	2AB8	Awaiting Funding
Pepsi Cola Bottling Co.	PETRO	UST	11546	3BF5	Inactive
Perkins Quick Stop	PETRO	UST	09075	3BF5	Inactive
Perry's Grocery	PETRO	UST	03426	2BB4	Active corrective action
Phoenix Medical Technology Site	OTHER	UST	EPA ID: SCD107925315 BLWM File #: 51989	N/A	No activity at this time
Port Unit 204	PETRO	UST	09060	2AA4	Active corrective action
Pressley & Son Variety Store	PETRO	UST	09089	1D4	Active corrective action
R W McChutchen Grocery	PETRO	UST	09082	2BB6	Contacted
S A Guerry & Son	PETRO	UST	09084	1D4	Active corrective action

Notes: Abbreviations include **PETRO-** Petroleum Products. **VOC-** Volatile Organic Compounds. **UST-** Underground Storage Tank. **S/L-** Spills/Leaks. **AGT-** Above ground Storage Tank. **LF-** Landfill. **STTF-** Septic Tank Tile Field. **UNK-** Unknown. **NO3-** Nitrates. **PEST/HERB-** Pesticides/ Herbicides.

Source: SC DHEC, 2008 South Carolina Groundwater Contamination Inventory.

Table G3- 2008 Williamsburg County Groundwater Contamination Inventory- Continued					
Contamination Incident	**Type of Contaminant**	**Source of Contamination**	**Site ID#**	**RBCA Classification for UST sites**	**Remarks**
Sam Quick Stop	PETRO	UST	09140	2BB1	Conducting investigation/ Risk Assessment
Sandridge Community	NO3	STTF	N/A	N/A	Site is in remediation phase. Marginal contamination by nitrate.
Santee Electric Coop Inc.	PETRO	UST	09937	4BC5	Inactive
Scotchman 62	PETRO	UST	11821	5B8	Awaiting Funding
Sharon Floyd Grocery	PETRO	UST	14189	2BB1	Conducting investigation/ Risk Assessment
Southern Agrl Chem/ Black River Hardwood	PEST/HERB	S/L	EPA ID: SCD003352515 BLWM File# 55753	N/A	No activity at this time
Southern Agricultural Plant Site	PEST/HERB	UNK	EPA ID: SCD067017053 BLWM File# 50893	N/A	No activity at this time
Spencers	PETRO	UST	09033	2BB1	Conducting investigation/ Risk Assessment
Strongs Grocery	PETRO	UST	03753	2BB4	Active corrective action
Swinnie Wards Grocery	PETRO	UST	14881	2AA1	Conducting investigation/ Risk Assessment
T & T Exchange	PETRO	UST	09061	2BB1	Conducting investigation/ Risk Assessment
Tanner Enterprises	PETRO	UST	09073	2BB5	Inactive
Tanners Money Saver	PETRO	UST	15512	3BF6	Contacted
Tisdales Quick Stop	PETRO	UST	18686	2AA4	Active corrective action
Venters Grocery	PETRO	UST	09081	2BB1	Conducting investigation/ Risk Assessment
W S McCollough & Sons Inc.	PETRO	UST	09032	2BB5	Inactive
Wards Corner Grocery	PETRO	UST	09062	1D1	Conducting investigation/ Risk Assessment
Wards Gulf	PETRO	UST	09132	3BF1	Conducting investigation/ Risk Assessment
Watfords Grocery	PETRO	UST	03703	2BB1	Conducting investigation/ Risk Assessment
Wilder Brothers	PETRO	UST	15189	3BF8	Awaiting Funding
William T Cooper	PETRO	UST	09117	1D9	CNFA
Williamsburg County Landfill	NONE	LF	Permit#: 451001-1101	N/A	In monitoring phase
Williamsburg County Public Works	PETRO	UST	12366	3BF1	Conducting investigation/ Risk Assessment
Winslow Chevrolet Inc.	PETRO	UST	09026	2BB7	Approved Monitored Natural Attenuation
Youngs 30	PETRO	UST	09129	4BC5	Inactive
Youngs 62	PETRO	UST	16529	2BB1	Conducting investigation/ Risk Assessment

Notes: Abbreviations include **PETRO-** Petroleum Products. **VOC-** Volatile Organic Compounds. **UST-** Underground Storage Tank. **S/L-** Spills/Leaks. **AGT-** Above ground Storage Tank. **LF-** Landfill. **STTF-** Septic Tank Tile Field. **UNK-** Unknown. **NO3-** Nitrates. **PEST/HERB-** Pesticides/ Herbicides.

Source: SC DHEC, 2008 South Carolina Groundwater Contamination Inventory.

APPENDIX H- Inventory of NPDES General Permits for Industrial Stormwater Sites

Activities that take place at industrial facilities, such as material handling and storage, are often exposed to wet weather. As runoff comes into contact with these activity sites, it can pick up pollutants and transport them to a nearby storm sewer system or directly to the closest surface waterbody. To minimize the impact of stormwater discharges from industrial facilities, the NPDES program includes an industrial stormwater permitting component that covers ten categories of industrial activity, that require authorization under an NPDES industrial stormwater permit for stormwater discharges. The ten industrial activity categories that this general permit is intended to cover include:

- Facilities subject to federal stormwater effluent discharge standards in 40 CFR Parts 405-471
- Heavy manufacturing (for example, paper mills, chemical plants, pretroleum refineries, and steel mills and foundries)
- Coal and mineral mining and oil and gas exploration and processing
- Hazardous waste treatment, storage, or disposal facilities
- Landfills, land application sites, and open dumps with industrial wastes
- Metal scrapyards, salvage yards, automobile junkyards, and battery reclaimers
- Steam electric power generating plants
- Transportation facilities that have vehicle maintenance, equipment cleaning, or airport deicing operations
- Treatment works treating domestic sewage with a design flow of 1 million gallons a day or more
- Light manufacturing (For example, food processing, printing and publishing, electronic and other electrical equipment manufacturing, and public warehousing and storage).

The State of South Carolina NPDES General Permit for Storm Water Discharges Associated with Industrial Activities can be accessed via: http://www.scdhec.gov/environment/water/docs/SCR000000.pdf. This appendix lists all of the industrial facilities located in the Waccamaw region that are currently covered under this permit program.

Table H1: Georgetown County Industrial Stormwater General NPDES Permit Inventory

NPDES Permit #	Facility Name	SIC Code /Description
SCR001950	Auto Used Parts, INC.	**5015:** Motor Vehicle Parts, Used
SCR003270	City of Georgetown	**4952:** Sewerage Systems
SCR002137	D&L Trucking, INC	**4213:** Trucking, Except Local
SCR001136	Eagle Electric Manufacturing Company	**3643:** Current Carrying Wiring Devices
SCR002929	Geo Specialty Chem, INC.	**2819:** Industrial Inorganic Chemicals, Not Elsewhere Classified
SCR002223	Georgetown Container	**2653:** Corrugated and Solid Fiber Boxes
SCR001181	Georgetown County	**4953:** Refuse Systems
SCR000275	H+S Oil Co. Inc	**5171:** Petroleum Bulk Stations and Terminals
SCR000278	H+S Oil Co. Inc	**5171:** Petroleum Bulk Stations and Terminals
SCR001860	Insteel Industries	**3315:** Steel Wiredrawing and steel Nails and Spikes
SCR001788	International Paper	**2621:** Paper Mills
SCR001318	International Paper	**2411:** Logging
SCR001898	Martion Marietta	**1422:** Crushed and Broken Limestone
SCR000638	Pheonix Medical Technologies, INC.	**3089:**Plastics Products, Not Elsewhere Classified
SCR003051	Praxair Incorporated	**2813:** Industrial Gases
SCR000172	Progress Rail Services	**5093:** Scrap and Waste Materials
SCR000677	Ryan-Walsh, INC.	**4491:** Marine Cargo Handling
SCR000360	SC Dept of Transportation	**4231:** Terminal and Joint Terminal Maintenance Facilities for Motor Freight Transportation
SCR000357	SC Dept. of Transportation	**4221:** Farm Product Warehousing and Storage
SCR000184	SC State Ports Authority	**4491:** Marine Cargo Handling
SCR003196	Unicon Concrete, LLC	**3273:** Ready Mixed Concrete
SCR001024	Westvaco Corporation	**2499:** Wood Products, Not Elsewhere Classified

Source: *US Environmental Protection Agency: Permit Compliance System Database.*

Table H2: Horry County Industrial Stormwater General NPDES Permit Inventory		
NPDES Permit #	**Facility Name**	**SIC Code /Description**
SCR003428	A.O. HARDEE & SONS, INC.	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCR001769	APAC-CAROLINA, INC	**2951:** ASPHALT PAVING MIXTURES AND BLOCKS
SCR003536	APAC-CAROLINA, INC.	**3273:** READY-MIXED CONCRETE
SCR000002	AVX KYOCERA	**3675:** ELECTRONIC CAPACITORS
SCR003173	B.O.A.C. MARINE	**4493:** MARINAS
SCR003096	BLACK CREEK MINING CO	**1442:** CONSTRUCTION SAND AND GRAVEL
SCR002065	CHAVIS VAN & STORAGE, INC.	**4231:** TERMINAL AND JOINT TERMINAL MAINTENANCE FACILITIES FOR MOTOR FREIGHT TRANSPORTATION
SCR003473	CHEROKEE, PHILLIPS, & JORDAN	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCR003591	CHIQUOLA SPINNERS LLC	**2281:** YARN SPINNING MILLS
SCR003012	COBURG DAIRY, INC.	**4222:** REFRIGERATED WAREHOUSING AND STORAGE
SCR003089	COCA COLA BOTTLING COMPANY	**4225:** GENERAL WAREHOUSING AND STORAGE
SCR002107	COLUMBIA FARMS	**2015:** POULTRY SLAUGHTERING AND PROCESSING
SCR000046	CONBRACO INDUSTRIES, INC.	**3491:** INDUSTRIAL VALVES
SCR003431	CP&J CONSTRUCTION	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCR003574	DPD TEAM CONCRETE-CLOSED	**3273:** READY-MIXED CONCRETE
SCR002181	FEDERAL EXPRESS	**4215:** COURIER SERVICES, EXCEPT BY AIR
SCR002201	FREDRICKSON MOTOR EXPRESS CORP	**4231:** TERMINAL AND JOINT TERMINAL MAINTENANCE FACILITIES FOR MOTOR FREIGHT TRANSPORTATION
SCR003325	HAGUE MARINA	**4493:** MARINAS
SCR002262	HARDEE MANUFACTURING COMPANY	**3523:** FARM MACHINERY AND EQUIPMENT
SCR003534	HARDWICK LANDSCAPING	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCR000359	HORRY CO SOLID WASTE AUTHORITY	**4581:** AIRPORTS, FLYING FIELDS, AND AIRPORT TERMINAL SERVICES
SCR002123	HORRY COUNTY DEPT OF AIRPORTS	**4581:** AIRPORTS, FLYING FIELDS, AND AIRPORT TERMINAL SERVICES
SCR003048	LISTON T. HARDEE	**1459:** CLAY, CERAMIC, AND REFRACTORY MINERALS, NOT ELSEWHERE CLASSIFIED
SCR003527	MG INDUSTRIES	**2813:** INDUSTRIAL GASES
SCR002388	MYRTLE BEACH JETPORT	**4581:** AIRPORTS, FLYING FIELDS, AND AIRPORT TERMINAL SERVICES
SCR003326	NORTH MYRTLE BEACH MARINA	**4493:** MARINAS
SCR003244	ONSITE CONCRETE INC	**3273:** READY-MIXED CONCRETE
SCR000659	PPM CRANES INCORPORATED	**3537:** INDUSTRIAL TRUCKS, TRACTORS, TRAILERS, AND STACKERS
SCR003472	PRACTICE ONE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCR000500	RICHARD A. HOFFMAN	**2491:** WOOD PRESERVING
SCR000365	S. C. DEPT. OF TRANSPORTATION	**4231:** TERMINAL AND JOINT TERMINAL MAINTENANCE FACILITIES FOR MOTOR FREIGHT TRANSPORTATION
SCR000369	S. C. DEPT. OF TRANSPORTATION	**4231:** TERMINAL AND JOINT TERMINAL MAINTENANCE FACILITIES FOR MOTOR FREIGHT TRANSPORTATION
SCR000361	S. C. DEPT. OF TRANSPORTATION	**4231:** TERMINAL AND JOINT TERMINAL MAINTENANCE FACILITIES FOR MOTOR FREIGHT TRANSPORTATION
SCR000362	S. C. DEPT. OF TRANSPORTATION	**4231:** TERMINAL AND JOINT TERMINAL MAINTENANCE FACILITIES FOR MOTOR FREIGHT TRANSPORTATION
SCR000363	S. C. DEPT. OF TRANSPORTATION	**4231:** TERMINAL AND JOINT TERMINAL MAINTENANCE FACILITIES FOR MOTOR FREIGHT TRANSPORTATION
SCR000368	S. C. DEPT. OF TRANSPORTATION	**4231:** TERMINAL AND JOINT TERMINAL MAINTENANCE FACILITIES FOR MOTOR FREIGHT TRANSPORTATION
SCR002697	TURNER'S USED PARTS, INC.	**5015:** MOTOR VEHICLE PARTS, USED
SCR003197	UNICON CONCRETE, LLC	**3273:** READY-MIXED CONCRETE
SCR003288	UNICON CONCRETE, LLC	**3273:** READY-MIXED CONCRETE
SCR003195	UNICON CONCRETE, LLC	**3273:** READY-MIXED CONCRETE
SCR000839	UNITED PARCEL SERVICE INC	**4215:** COURIER SERVICES, EXCEPT BY AIR
SCR000871	WALDEN B GRAHAM G+C MINING CO	**1422:** CRUSHED AND BROKEN LIMESTONE
SCR000872	WARREN JONES	**2843:** SURFACE ACTIVE AGENTS, FINISHING AGENTS, SULFONATED OILS, AND ASSISTANTS
SCR003260	WCI INVESTMENTS LP	**1442:** CONSTRUCTION SAND AND GRAVEL
SCR003565	WHITE & SON, INC.	**1459:** CLAY, CERAMIC, AND REFRACTORY MINERALS, NOT ELSEWHERE CLASSIFIED
SCR003480	WILLIS CONSTRUCTION COMPANY	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCR003478	WILLIS CONSTRUCTION COMPANY	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCR003479	WILLIS CONSTRUCTION COMPANY	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCR001053	WOLVERINE BRASS INC	**3432:** PLUMBING FIXTURE FITTINGS AND TRIM
Source: *US Environmental Protection Agency: Permit Compliance System Database.*		

Table H3: Williamsburg County Industrial Stormwater General NPDES Permit Inventory		
NPDES Permit #	**Facility Name**	**SIC Code /Description**
SCR001765	APAC- CAROLINA, INC.	**2951:** Paving Mixtures and Blocks
SCR003333	Don's Scrap Iron	**5093:** Scrap and Waste Materials
SCR002152	Drexel Heritage Furnishings	**2599:** Furniture and Fixtures, Not Elsewhere Classified
SCR001262	Firestone Building Products CO.	**3069:** Fabricated Rubber Products, Not Elsewhere Classified
SCR000273	H+S Oil Co.	**5171:** Petroleum Bulk Stations and Terminals
SCR003308	James F. Wilson	**2421:** Sawmills and Planing Mills, General
SCR000491	M.A. Hanna Company	**3069:** Fabricated Rubber Products, Not Elsewhere Classified
SCR002363	McAllister Motors Incorporated	**5015:** Motor Vehicle Parts, Used
SCR000578	Milliken and Company	**2221:** Broadwoven Fabric Mills, Manmade Fabric and Silk
SCR003437	Palmetto Synthetics LLC	**2299:** Textile Goods, Not Elsewhere Classified
SCR000372	SC Dept of Transportation	**4231:** Terminal and Joint Terminal Maintenance Facilities for Motor Freight Transportation
SCR000373	SC Dept of Transportation	**4231:** Terminal and Joint Terminal Maintenance Facilities for Motor Freight Transportation
SCR003249	SC Army National Guard	**4212:** Local Trucking without Storage
SCR003360	SC Prestress Kingstree	**1442:** Construction Sand and Gravel
SCR002827	Town of Kingstree	**4952:** Sewerage Systems
SCR000896	Tupperware Company	**3089:** Plastic Products, Not Elsewhere Classified
SCR002943	Williamsburg County	**4953:** Refuse Systems
Source: *US Environmental Protection Agency: Permit Compliance System Database.*		

APPENDIX I- Inventory of NPDES General Permits for Non-metal Mineral Mining Facilities

The State of South Carolina NPDES General Permit for Discharges from Non-metal Mineral Mining Facilities covers several mining related discharges including stormwater, mine dewatering, mine process wastewater, mine equipment wash water, and suction dredge water. The types of mines covered by this permit include sand, gravel, clay, fill dirt, kaolin, vermiculite, dimension stone quarries, crushed stone quarries, and other types of nonmetallic mineral mines or quarries as approved by SC DHEC on a case by case basis.

The NPDES General Permit for Dischargers Associated with Nonmetal Mineral Mining Discharges can be accessed via: http://www.scdhec.gov/environment/water/docs/scg730000.pdf

The following tables list mining facilities located in the Waccamaw Region that are covered by this permit.

Table I1: Georgetown County Nonmetal Mineral Mining Facilities General NPDES Permit Inventory

NPDES Permit #	Facility Name	SIC Code/ Description
SCG731076	Ben Cox Co/ Mansfield Mine	**1499:** Miscellaneous Nonmetallic Minerals, Except Fuels
SCG730831	Ben Cox Co/ White Hall Mine	**1499:** Miscellaneous Nonmetallic Minerals, Except Fuels
SCG730512	Black River Grading/ Lambert Pit	**1499:** Miscellaneous Nonmetallic Minerals, Except Fuels
SCG730650	BMCO/ Wheeler Pit/ SCDOT	**1499:** Miscellaneous Nonmetallic Minerals, Except Fuels
SCG730835	C-Pin Invest/ C-Pin Mine	**1499:** Miscellaneous Nonmetallic Minerals, Except Fuels
SCG643001	GCWSD Waccamaw Neck Water Plant	**4941:** Water Supply
SCG645051	GCWSD Plantersville EDR	**4941:** Water Supply
SCG646058	GCWSD Plantersville EDR WTP	**4941:**Water Supply
SCG646032	Georgetown WTP	**4941:** Water Supply
SCG645013	City of Georgetown WTP	**4941:** Water Supply
SCG730034	GRD IMPROV TECH/ Georgetown LandF	**1455:** Kaolin and Ball Clay
SCG730806	Richardson Const/ Harmony Lakes	**1499:** Miscellaneous Nonmetallic Minerals, Except Fuels
SCG730807	Richardson Const/ Harmony Lakes 2	**1499:** Miscellaneous Nonmetallic Minerals, Except Fuels
SCG730491	Shelleys LC/ Taylor Pond Mine	**1499:** Miscellaneous Nonmetallic Minerals
SCG730525	Stone Const Co LLC/ Stone Mine	**1499:** Miscellaneous Nonmetallic Minerals
SCG730676	Stone Const/ Hwy 41 Pit/ SCDOT	**1499:** Miscellaneous Nonmetallic Minerals
SCG730836	Stone Const/ Sampit Mine	**1499:** Miscellaneous Nonmetallic Minerals

Source: *US Environmental Protection Agency: Permit Compliance System Database.*

Table I2: Williamsburg County Nonmetal Mineral Mining Facilities General NPDES Permit Inventory

NPDES Permit #	Facility Name	SIC Code/ Description
SCG730153	Barrett Brothers/ Hwy 52	**1499:** Miscellaneous Nonmetallic Minerals, Except Fuels.
SCG730220	Hardy D. Brown/ 527 Dirt Pit	**1499:** Miscellaneous Nonmetallic Minerals, Except Fuels.
SCG730361	L Dean Weaver/ R Lifrage Mine	**1499:** Miscellaneous Nonmetallic Minerals, Except Fuels.
SCG730962	RE Goodsong/ SC Hwy 377 Pit 3M	**1499:** Miscellaneous Nonmetallic Minerals, Except Fuels.
SCG730712	SC Prestress/ Sand Plant I	**1442:** Construction Sand and Gravel
SCG730201	Springfield Realty/ Double K Mine	**1442:** Construction Sand and Gravel
SCG730006	Stone Construction Company Pit	**1442:** Construction Sand and Gravel

Source: *US Environmental Protection Agency: Permit Compliance System Database.*

Table I3: Horry County Nonmetal Mineral Mining Facilities General NPDES Permit Inventory		
NPDES Permit #	**Facility Name**	**SIC Code/ Description**
SCG730129	ABC CORP OF SC/JOSHUA PIT	**1442:** CONSTRUCTION SAND AND GRAVEL
SCG730348	AO HARDEE&SON/FIRETOWER/PWRLNE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730739	AO HARDEE&SON/HEWITT ROAD PIT	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730445	AO HARDEE&SON/IP DETENT POND	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730364	ASHLEY ANDERSON	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730524	B M & P SANDPIT	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730130	BEAR BLUFF MATERIALS	**1442:** CONSTRUCTION SAND AND GRAVEL
SCG730850	BM&P/POND ROAD MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730314	BURNIE JORDAN/JORDANS SAND PIT	**1442:** CONSTRUCTION SAND AND GRAVEL
SCG730297	BUSHWACKER INC/SAND HILL PIT	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730057	C L BENTON SEA MIST MINE	
SCG730233	C L BENTON/CAROLINA FOREST MIN	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730380	C L BENTON/JACKSON BLUFF DOT	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730632	C OWENS & SON/OWENS PIT	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730259	CAP OF MB/RED BLUFF MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730036	CAVU INCORPORATED	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG731007	COASTAL SAND LLC/BRUTON MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730601	D & L SITEWORK/CATES BAY MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730874	D&L SITEWORK/GUNTERS ISLAND MI	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG731082	D&L/PEE DEE CROSSROADS MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730669	DALES LAND CONS/ALLEN DEW MINE	
SCG730910	EB BROWN SITEWORK/HAWKSBILL	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730829	FAITH LANDSCAPING/FAITH MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730016	FLORENCE BARNHILL MINE	**1442:** CONSTRUCTION SAND AND GRAVEL
SCG730887	FLOYD FARMS/FLOYD DIRT MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730482	G & G MINING CO/G & G MINE	**1411:** DIMENSION STONE
SCG731065	GOODSON CONST CO/INGRAM HWY 37	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730840	GOODSON CONST/JOHNSON MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730400	GOODSON/501 CBP BORROW PIT	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730381	GOODSON/BUSTER BROWN PIT	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730430	GOODSON/CLUBVIEW APT PIT 8	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730410	GOODSON/HOLMES PIT 3	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730412	GOODSON/R O COLLINS BP#4	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730228	GRAND STRAND AGG/GORETOWN MINE	**1422:** CRUSHED AND BROKEN LIMESTONE
SCG731088	GREY PLANT LLC/GREY PLANTATION	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG645042	GSW&SA/BULL CREEK WTP	**4941:**WATER SUPPLY
SCG646050	GSW&SA/BULL CREEK WTP	**4941:** WATER SUPPLY
SCG730791	HARDEE MINING/HARDEE MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG731089	HINSON/APACHE TRACT II MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730422	HOT MIX INC/ADRIAN MINE	**1442:** CONSTRUCTION SAND AND GRAVEL
SCG730310	HUCKS LANDSCAPING/HUCKS MINE 1	**1442:** CONSTRUCTION SAND AND GRAVEL
SCG730347	HUCKS LANDSCAPING/HUCKS MINE 8	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730875	JACOB JOHNSON LANDCLR/J&J MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730930	JARRETTS LANDCLEARING/HUGHES M	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730644	JAY & J CONST/HWY 76 & 9 PIT	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730762	KELCO/BAREFOOT DRIVE MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730965	KENNITH E JOHNSON/ALLEN PL MIN	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730871	L DEAN WEAVER/BELLE ERRACE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730897	L DEAN WEAVER/TUCKER MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG731095	L&L CONTRACTORS/MCCLAM PIT	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730631	LISTON HARDEE & SON/HARDEE PIT	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG645018	LITTLE RIVER WATER & SEWERAGE COMPANY INCORPORATED	**4941:** WATER SUPPLY
SCG730438	LOW LAND CONST/SELLERS POND MN	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730336	LUCKY STRIKE MINING OF SC/NO 1	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730817	LUMBER RIVER MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG646011	MYRTLE BEACH WTP	**4941:** WATER SUPPLY
SCG730075	MYRTLE BEACH FARMS/BENTON MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG641012	MYRTLE BEACH WATER RECLAMATION	**4941:** WATER SUPPLY
Source: *US Environmental Protection Agency: Permit Compliance System Database.*		

Table I3, Continued: Horry County Nonmetal Mineral Mining Facilities General NPDES Permit Inventory		
NPDES Permit #	**Facility Name**	**SIC Code/ Description**
SCG730941	NEXT STEP INC/KITTLE RESIDENCE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730876	OUTBACK SOURCE/BLACK ISLAND MI	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730272	P MINING CO/P MINING PIT #2	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730081	P MINING INCORPORATED	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730351	PALMETTO LAND PARTRS/BAREFOOT	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730800	PALMETTO PAVING/PALMETTO #1	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730118	R L CAUSEY LANDSCPG/VEREEN PIT	**1442:** CONSTRUCTION SAND AND GRAVEL
SCG730292	RE GOODSON/CAROLINA FOREST BLV	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730113	RICHARDSON & SONS RICKYS DIRT	**1442:** CONSTRUCTION SAND AND GRAVEL
SCG730136	ROBERT O COLLINS SOCASTEE PIT	**1442:** CONSTRUCTION SAND AND GRAVEL
SCG730237	ROBERT O COLLINS/544 MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730236	ROBERT O COLLINS/FORESTBROOK	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730267	ROBERT O COLLINS/LAKE RIDGE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730265	RON TEAGUE/LEES LANDING CIR MN	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730905	SODBUSTERS TURF/SMITH MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730397	SOUTHERN ASPHALT/CASTLEWOOD SD	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730352	SOUTHERN ASPHALT/EAGLE SOUTH	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730363	SOUTHERN ASPHALT/HOLMS FARM	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730146	SOUTHERN ASPHALT/HWY 90 PIT	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730903	STALVEYS CONST/CHARLES LEWIS	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730635	SUPERIOR SAND/BLACK CREEK MINE	**1442:** CONSTRUCTION SAND AND GRAVEL
SCG730549	T&J BUILDERS INC/TODD MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730883	T&J BUILDERS/T&J MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730082	THOMPKINS AND ASSOC/WEST MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730849	TONY COX HOME POND MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730909	TURFMEN INC/RECREATIONAL POND	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730838	TW HUNT CONST/ALL SAINTS MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730576	VEREEN CONCRETE/SAND RIDGE MN	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730316	WAKE STONE CORP/N MYRTLE BEACH	**1422:** CRUSHED AND BROKEN LIMESTONE
SCG730562	WEAVER COMPANY/CANNON SPRINGS	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730561	WEAVER COMPANY/MCNEILL MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730384	WEAVER CONSTRUCTION COMPANY INCORPORATED	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730389	WHITE & SONS/CHESTNUT PIT MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730953	WHITE & SONS/HARVEY RD MINE	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG730271	WHITE & SONS/HEWITT ROAD	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
SCG750026	WIZARD WASH INC	**7542:** CARWASHES
SCG730940	WORLEY TRUCKING/WORLEY MINE #3	**1442:** CONSTRUCTION SAND AND GRAVEL
SCG730899	WRIGHT WAY INV DIRT PIT	**1499:** MISCELLANEOUS NONMETALLIC MINERALS, EXCEPT FUELS
Source: *US Environmental Protection Agency: Permit Compliance System Database.*		

APPENDIX J- Beach Monitoring Sites in the Waccamaw Region

Table J1- Beach Monitoring Sites, Horry and Georgetown Counties

Station #	Address	City/ County
WAC-001	59th Ave. N	North Myrtle Beach
WAC-002	45th Ave. N	North Myrtle Beach
WAC-002	30th Ave. N	North Myrtle Beach
WAC-003	16th Ave. N	North Myrtle Beach
WAC-004	3rd Ave. N	North Myrtle Beach
WAC-005	7th Ave. N	North Myrtle Beach
WAC-005A	9th Ave. N	North Myrtle Beach
WAC-006	17th Ave. N	North Myrtle Beach
WAC-007	33rd Ave. S	North Myrtle Beach
WAC-008	47th Ave. S	North Myrtle Beach
WAC-009	White Point Swash	White Point Swash
WAC-009A	Briarcliff Cabana	Briar Cliff Acres
WAC-010	2 miles N of Wyndham Hotel	Briar Cliff Acres
WAC-011	Lands End Resort- Arcadia	Horry County, Arcadia Beach
WAC-012	Wyndham Hotel Arcadia	Horry County
WAC-013	Sands Ocean Club Arcadia	Horry County
WAC-014	Singleton Swash Arcadia	Horry County
WAC-015	Bear Branch Swash	Myrtle Beach
WAC-016	77th Ave. N	Myrtle Beach
WAC-016A	Canes Patch Swash	Myrtle Beach
WAC-017	64th Ave. N	Myrtle Beach
WAC-017A	Deep Head Swash	Myrtle Beach
WAC-018	50th Ave. N	Myrtle Beach
WAC-019	34th Ave. N	Myrtle Beach
WAC-020	24th Ave. N	Myrtle Beach
WAC-021	8th Ave. N	Myrtle Beach
WAC-022A	Withers Swash	Myrtle Beach
WAC-024	23rd Ave. S	Myrtle Beach
WAC-025A	Midway Swash	Myrtle Beach
WAC-026	Nash Drive	Horry County Beaches, Springmaid
WAC-027	Myrtle Beach State Park	Horry County Beaches
WAC-028	Beaver Dam Creek (at Pirateland)	Horry County Beaches
WAC-029	Ocean Lakes Campground N	Horry County Beaches
WAC-029A	Ocean Lakes Campground S	Horry County Beaches
WAC-030	16th Ave. N	Surfside Beach
WAC-031	11th Ave. N Dogwood Swashe	Surfside Beach
WAC-031A	Swash @ 5th Ave. N	Surfside Beach
WAC-032	3rd Ave. N	Surfside Beach
WAC-033	3rd Ave. S	Surfside Beach
WAC-034	8th Ave. S	Surfside Beach
WAC-035	13th Ave. S	Surfside Beach
WAC-036	Hawes Ave.	Horry Co. Beaches, Garden City
WAC-037	Azalea Ave.	Horry Co. Beaches, Garden City
WAC-038	Garden City Point	Georgetown Co. Beach, Garden City
WAC-039	North Access, Huntington Beach State Park	Georgetown County Beaches
WAC-040	Visitors Center- Huntington Beach State Park	Georgetown County Beaches
WAC-041	Songbird Lane	Georgetown Co. Beaches, Litchfield
WAC-042	Litchfield Inn	Georgetown Co. Beaches
WAC-043A	1st left past gate	Georgetown Co. Beaches
WAC-044A	Public Access 2nd/Atlantic Beach	Pawley's Island
WAC-045A	Public Access Springs/ Hazard Ave.	Pawley's Island
WAC-046	Pawley's Island, South Parking	Pawley's Island
WAC-047	Luvan Way	Georgetown Co Beaches, Debordieu
WAC-048	Lafayette/ Ocean Green Blvd.	Georgetown Co Beaches, Debordieu

Source: *SC DHEC, http://www.scdhec.gov/environment/water/beachmondata.aspx*

APPENDIX K- Shellfish Management Area Monitoring Sites

SC DHEC oversees a shellfish program that is designed to monitor the sanitary conditions of shellfish harvesting areas throughout the state in order to protect the public health of shellfish consumers. SC DHEC has established 25 shellfish management areas throughout the state, six of which are located in Horry and Georgetown Counties. A summary of locations and water quality monitoring sites within each shellfish management area is provided in the tables below. A status of each shellfish area is also provided in each table. A classification system is utilized to assess and regulate the harvesting of shellfish in each designated shellfish management area. A brief description of each classification category is provided below:

Approved - Areas that are normally open for the direct marketing of shellfish for human consumption. Approved areas must not exceed an established water quality standard.
Conditionally Approved - Areas that meet criteria for an Approved classification except under predictable conditions. Closure criteria and subsequent re-opening procedures are described in an area-specific management plan. Conditions that normally result in these temporary closures are often rainfall-induced (non-point source runoff or excessive river levels/flows).
Restricted - Areas exceeding Approved area water quality standards and normally closed for direct harvesting activities but where harvesting may be allowed by special permit. Shellfish from Restricted areas are frequently relocated (Relayed) to Approved areas where they remain planted for a period of time adequate to allow natural cleansing.
Prohibited – Areas that are administratively closed for the harvesting of shellfish for any purposes related to human consumption. These closures are established adjacent to permitted wastewater discharges, marina facilities, or areas containing multiple point sources of pollution. The Prohibited classification is not based upon violation of a bacteriological standard.

Table K1: Shellfish Management Area 1 Monitoring Sites- Little River Inlet

Monitoring Site #	Location	2009 Status
01-01	Little River Jetty	**Approved:** None
01-02	Mouth of Dunn Sound Creek	**Conditionally Approved:** None
01-05	Big Bend up Dunn Sound Creek	**Restricted:** 2143 acres 1. All waters of the Hog Inlet estuary 2. All waters of Dunn Sound 3. All waters of Little River Inlet, south and east of the southeastern point of Little River Neck (Tilghman Point)
01-06	Bridge to Waites Island	
01-07	Hog Inlet	
01-17	42nd Avenue- Cherry Grove	**Prohibited:** 1146 acres 1. All waters of the Atlantic Intracoastal Waterway 2. All waters of the Little River 3. All waters of Calabash Creek 4. All waters of Milliken Cove 5. All waters of Little River Inlet north of the southeastern point of Little River
01-17A	53rd Ave. Bridge on Canal	
01-18	Bunn Sound at Hog Inlet	
01-19	53rd Avenue at Main Creek	

Source: *SC DHEC, Bureau of Water. Shellfish Management Area 01 2009 Annual Update*

Table K2: Shellfish Management Area 2 Monitoring Sites- White Point Swash, Singleton Swash, and Cane Patch Swash

Monitoring Site #	Location	2009 Status
02-01	White Point Swash	**Approved:** None
02-02	Singleton Swash	**Conditionally Approved:** None
		Restricted: 100 acres 1. All waters of White Point Swash 2. All waters of Singleton Swash 3. All Waters of Cane Patch Swash
02-03	Cane Patch Swash	**Prohibited:** None

Source: *SC DHEC, Bureau of Water. Shellfish Management Area 02 2009 Annual Update*

Table K3: Shellfish Management Area 3 Monitoring Sites- Withers Swash, Midway Inlet

Monitoring Site #	Location	2009 Status
03-01	Withers Swash	**Approved:** None
		Conditionally Approved: None
03-02	Midway Swash	**Restricted:** 1. All waters of Wthers Swash **2.** All waters of Midway Swash
		Prohibited: None

Source: *SC DHEC, Bureau of Water. Shellfish Management Area 03 2009 Annual Update*

Table K4: Shellfish Management Area 4 Monitoring Sites- Murrells Inlet, Midway Inlet, Pawleys Inlet

Monitoring Site #	Location	2009 Status
04-01	Main Creek at Atlantic Avenue Bridge	**Approved:** ***Murrells Inlet:*** 1. Those portions of Main Creek, including Oyster Cove, extending from Station 04-05 to Station 04-25; 2. Culture Permit area 356 3. Those portions of Oaks Creek and areas adjacent to Drunken Jack Island from Station 04-05 to Station 04-28. 4. Southern portions of the estuary including State Shellfish Ground S354 and portions of Public Shellfish Ground R355 and R 351 5. All portions of the central part of the Murrells Inlet estuary excluding any portions of Parsonage Creek, Allston Creek and any portion of Captain Dick's - Voyagers View Marina closure zone; 6. C370 and portions of C371 east of Main Creek and those portions of C371 south of Flagg Creek, excluding the Marina Colony closure zone. ***Pawleys Island/ Litchfield:*** None
04-02	Main Creek at Mickey Spillane's Home	
04-03A	In Main Creek, Southeast side of the Prohibited Area near Captain Dick's Marina	
04-03B	In Main Creek, on the Northwest side of the Prohibited Area near Captain Dick's Marina	
04-04A	Garden City Canal due East of Entrance to Flagg Creek	
04-04B	Northern Boundary of Marlin Quay Closure Zone- Main Creek	
04-04C	Western Boundary of Marlin Quay Closure Area- Main Creek	
04-05	Murrells Inlet- Range Marker	
04-06	Allston Creek at Weston Flat	**Conditionally Approved:** ***Murrells Inlet:*** None ***Pawleys Island/Litchfield:*** None
04-07	Allston Creek- Hughes Landing	
04-08	Parsonage Creek at Nance's Dock	**Restricted:** ***Murrells Inlet*:** 1. Portions of the Garden City Canal north of Station 04-04A 2. All portions of Main Creek and the adjacent flats to the north of an imaginary line extending east to west from Station 04-04A through Station 04-25 along the high marsh to an intersect with the Prohibited closure boundary east of Marina Colony 3. All waters of Parsonage Creek extraneous of marina closure zones 4. All small feeder creeks and marsh adjacent to the mainland and Allston Creek extending from the northern end of Allston Creek to a point 200 meters south of Hughes Landing; 5. Allston Creek in its entirety, from Parsonage Creek canal to Oaks Creek (near Station 04-24). Where not included in a previous description, this will also include all tributary creek mouths and marshlands within approximately 75 feet of Allston Creek; 6. Portions of marshlands and flats adjacent to and northwest of Allston Creek (near Station 04-07); **7.** Those waters southwest of an imaginary line extending from Huntington Beach through Station 04-28 and continuing to the mainland. This line is approximately 560 meters the northeast and parallel to the Huntington Beach State Park Causeway. ***Pawleys Island/ Litchfield:*** All waters
04-08A	Oyster (Carr) landing at Huntington Beach Station Park	
04-09	Clubhouse Creek at Litchfield Boulevard Bridge	
04-10	Shell Avenue and Pawley's Island Creek	
04-11	North Causeway Bridge at Pawley's Island Creek	
04-12	South Causeway at Pawley's Island Creek	
04-13	Pawley's Inlet	
04-14	Dock- End of Sportsman Boulevard	
04-15	Midway Inlet	
04-16	Parsonage Creek at Chicken Farm Ditch	
04-17A	Southwest Corner of the Voyager View Marina Prohibited Zone in Parsonage Creek	**Prohibited:** ***Murrells Inlet*** 1. Those waters within approximately 1000 feet of Captain Dick's/ Voyager View (closed) Marinas 2. Those Waters within approximately 1000 feet of the docking facilities at Bovines and Snug Harbor 3. Those waters within approximately 1000 feet of Marina Colony 4. Those waters within approximately 1000 of the Marlin Quay Marina ***Pawleys Island/ Litchfield:*** None
04-18	North Boundary of Clambank Flats POG	
04-19	Clubhouse Creek- First Bend South of Salt Marsh Cove	
04-21	South Pawley's Island Boat Landing	
04-23	Main Creek at Oyster Cove	
04-24	Oaks Creek at First Curve	
04-25	Main Creek at Flagg Creek	
04-26	Garden City Canal at the "Old Boat Wreck"	
04-27	Main Creek, Opposite Entrance to Mt. Gilead Canal	
04-28	Oak's Creek, Approximately 150 Meters From the Huntington Beach State Park Causeway	
04-29	Oyster Cove, South Branch	
04-30	Oyster Cove, North Branch	
04-31	Woodland Creek- 100 Meters East of Mainland	

Source: *SC DHEC, Bureau of Water. Shellfish Management Area 04 2009 Annual Update*

Table K5: Shellfish Management Area 5 Monitoring Sites- North Inlet, Winyah Bay Entrance, Mud Bay, Winyah Bay		
Monitoring Site#	**Location**	**2009 Status**
05-01	Jones Creek at Nancy Creek	**Approved:** 1. Central portions of the North Inlet estuary not listed below 2. Southern portions of Winyah Bay, seaward of an imaginary line extending northeast from the mouth of Mosquito Creek on South Island, through Station 05-21, and intersecting with the northwestern corner of the northern most Shell Island, and from there continuing southeast to the mainland shore of North Island. **3.** Mother Norton Shoals and tidal portions of Sand Island
05-02	Noble Slough	
05-03	North Inlet	
05-04	Town Creek at Debidue Creek	
05-05	Oyster Bay near Cutoff Creek	
05-06	No Man's Friend Creek at Mud Bay	**Conditionally Approved:** None
05-07	Jones Creek at Mud Bay	
05-08	Town Creek at Sixty Bass Creek	**Restricted:** 1. All portions of North Inlet northward of the confluence of Debidue Creek and Bass Hole Bay; 2. Southern portions of North Inlet, extending from the confluence of Noble Slough and Jones Creek southward, including Noble Slough, Haulover Creek, Boor Creek, Nancy Creek, Little Jones Creek, Dividing Creek, Sign Creek and Cotton Patch 3. Southern portions of Town Creek, from it's confluence with Sixty Bass Creek and the southern entrance to Clambank Creek, southward to Mud Bay. This includes Sawmill Creek, Town Creek, Cutoff Creek, Mud Creek, Oyster Bay, and No Mans Friend Creek **4.** Portions of Mud Bay and Winyah Bay, eastward of an imaginary line extending from the confluence of Winyah Bay and the eastern shore of the Estherville Minum Creek Canal northward to a point of intersection with the northwestern corner of the northern most Marsh Island, and from there continuing across Mud Bay to the mainland marsh. This area extends southeastward in Winyah bay to a line extending from the South Island shore, approximately 400 meters west of Mosquito Creek, to the spoil islands approximately 800 meters southeast of Malady Bush Island. This line then turns and extends southeastward to the North Island shore.
05-09	Town Creek at Southern Reach of Clambank Creek	
05-10	Jones Creek at Duck Creek	
05-11	Town Creek at Bread and Butter Creek	
05-12	Old Man Creek and Sea Creek Bay	
05-13	Debidue Creek at Boat Basin	
05-14	Mid-Channel Island, Bly Creek	
05-15	Debidue Creek and Cooks Creek	
05-16	Debidue Creek and Bass Hole Bay	
05-20	Winyah Bay Main Channel, Buoy 19a, Range E	**Prohibited:** 1. Portions of Mud Bay and Winyah Bay, north and west of an imaginary line extending northeastward from the Estherville Minim Creek Canal (AIWW) to the northwestern tip of Big Marsh Island, and continuing to the mainland; 2. All tidal portions of Cat and South Islands **3.** All portions of the Estherville Minim Creek Canal
05-21	Winyah Bay Main Channel, Buoy 17, Range E	
05-24	Winyah Bay Main Channel, Coast Guard Dock, Range C	
05-25	Winyah Bay, Tip of Western Channel Island	
Source: *SC DHEC, Bureau of Water. Shellfish Management Area 05 2009 Annual Update*		

Table K6: Shellfish Management Area 6A Monitoring Sites- North Santee Inlet, South Santee Inlet		
Monitoring Site#	**Location**	**2009 Status**
06A-01	South Santee River at Alligator Creek	**Approved:** None
06A-01A	South Santee River near the midpoint of Grace Island	**Conditionally Approved:** 1. Portions of North Santee Bay extending seaward from Station 06A-03 2. Portions of the North Santee River extending seaward from Station 06A-04B
06A-02	South Santee Inlet	
06A-03	North Santee River at Beach Creek	
06A-04	North Santee Inlet	**Restricted:** 1. All portions of the South Santee River and its tributaries 2. Portions of the North Santee River upstream of Station 06A-04B, including all tributaries 3. All portions of the Intracoastal Waterway 4. Portions of North Santee Bay upstream of Station 06A-03, including all tributaries.
06A-04A	North Santee Bay- East of Cane Island	
06A-04B	North Santee River- SW of Cane Island	
06A-04C	North Santee River near the Northwestern tip of Cane Island	
06A-05	North Santee River and Mosquito Creek	
06A-11	Atlantic Intracoastal Waterway at Minim Creek	**Prohibited:** None
Source: *SC DHEC, Bureau of Water. Shellfish Management Area 06A 2009 Annual Update*		

APPENDIX L- Section 208 Plan Amendments from 1999-2010

Table X below provides a list of Section 208 Plan Amendments for the Waccamaw region from FY 1999-2010. The list includes both Minor Amendments and Major Amendments. A brief description of the scope of each Section 208 Plan Amendment is included.

Table L1: Section 208 Plan Amendments: 1999-2010

Date of Resolution Approval	Affected 208 Management Agencies	Proposal Description
May 10, 1999	Town of Andrews Georgetown County WSD City of Georgetown	Incorporation of Carvers Bay, Choppee, Oatland, Plantersville, Sampit, and Woodland Communities and the Town of Andrews into the City of Georgetown WWTF planning area. Wastewater from these areas will be conveyed through the Georgetown County WSD collection system and be treated at the City of Georgetown WWTF.
July 12, 1999	Georgetown County WSD City of Georgetown	Incorporation of a Preliminary Engineering Report which describes the relocation of extended aeration activated sludge facility operated by Georgetown County WSD from the existing site of the Sampit School to its new location on Woodland Ave. This relocation is a temporary measure to serve the new school until a new conveyance interceptor can be constructed on US HWY 521. At that time, wastewater from the school will be conveyed to the City of Georgetown WWTF for treatment and final disposal.
August 9, 1999	All NPDES permit holders which discharge to the Waccamaw River/ Atlantic Intracoastal Waterway System.	Approval of the Ultimate Oxygen Demand wasteload allocations to meet the water quality criteria set forth in the Biochemical Oxygen Demand TMDL for the Waccamaw River/ Atlantic Intracoastal Waterway system developed by SC DHEC.
December 13, 1999	City of Georgetown	Facility upgrade to construct a 12MGD Sequential Batch Reactor treatment facility to replace a 4.5 MGD multi-cell aerated lagoon treatment facility.
February 14, 2000	Williamsburg County Water and Sewer Authority	Incorporation of the selected alternative identified in the Preliminary Engineering Report for the Williamsburg County Southwest Regional WWTF. The proposed facility is a multi-cell aerated lagoon with a treatment capacity of 0.6 million gallons per day (MGD). The treatment facility will service the Towns of Greeleyville and Lane, both of which were identified by SC DHEC as Imminent Health Hazard Communities due to the high number of failing septic systems located in the area.
April 10, 2000	City of Myrtle Beach	Incorporation of a Preliminary Engineering Report for upgrading and expanding the Myrtle Beach WWTF. The project would be completed in three separate phases. Phase 1 is a facility upgrade to meet more stringent effluent permit limits at the existing 17.0 MGD facility. Phase 2 is a facility expansion to a design flow of 19.0 MGD Phase 3 is a facility expansion to a design flow of 22.0 MGD
May 8, 2000	Grand Strand WSA	Incorporation of a Preliminary Engineering Report outlining the construction of the North Area Buist Tract Force Main. The 16in force main will be constructed from the Vereen WWTF to the Buist Tract along Long Bay Rd and Henry Rd to connect to existing force mains along Perry Rd and Royal Oak Boulevard. Flows of up to 2.0 MGD will be transferred to Central WWTF or Schwartz WWTF ton increase capacity and operational flexibility.
September 10, 2001	North Myrtle Beach Grand Strand WSA	1. Incorporation of a Preliminary Engineering Report to upgrade and expand the Ocean Drive and Crescent Beach WWTFs. The capacity of the Ocean Drive facility would increase from 3.4 to 4.5 MGD. The capacity of the Crescent Beach facility would increase from 2.1 to 2.9 MGD. Upgrades would also include higher removal efficiencies for ammonia and other organic residuals. Aeration capacities would also be increased at both facilities. 2. A modified interlocal agreement that allows the city of North Myrtle Beach to transmit up to 3.0MGD of untreated wastewater for treatment and disposal at Grand Strand WSA's Vereen WWTF. The Ultimate Oxygen Demand allocation would be redistributed to reflect the conditions of this interlocal agreement. New allocations are 841.75 UOD lbs/day to North Myrtle Beach for the Crescent Beach and Ocean Drive WWTFs and 796.25 UOD lbs/day to Grand Strand WSA for the Vereen WWTF.

Table L1: Section 208 Plan Amendments: 1999-2010		
December 10, 2001	Grand Strand WSA	Incorporation of a Preliminary Engineering Report to expand from a 2.5 MGD facility to a 7 MGD facility. The PER outlines plans to construct a new 7.0 MGD Kruger Oxidation Ditch advanced wastewater treatment system at the existing facility site. The existing treatment basins will be converted into sludge handling facilities.
June 10, 2002	City of Loris Grand Strand WSA	Grand Strand WSA agrees to take over responsibility of the operation and maintenance of the City of Loris WWTF. City of Loris is redesignated as a point source agency for wastewater collection only. .
July 8, 2002	Grand Strand WSA	Incorporation of a Preliminary Engineering Report that outlines plans to interconnect the Conway WWTF with the Bucksport WWTF. The intention is to divert up to 0.2 MGD of wastewater from Conway WWTF to the Bucksport WWTF.
July 8, 2002	Grand Strand WSA	1. Incorporation of the Preliminary Engineering Report that outlines plans to expand the capacity of the Bucksport WWTF from 0.2 MGD to 0.4 MGD. 2. Incorporation of a Preliminary Engineering Report that outlines plans to expand the convert the Longs WWTF from a 0.2 MGD aerated lagoon system to a 0.95 MGD activated sludge alternate sequencing system.
October 14, 2002	Grand Strand WSA	Incorporation of a Preliminary Engineering Report to expand the design capacity of the Schwartz WWTF in two phases. The current design capacity is 12.6MGD. The PER proposes to construct two 10.0MGD oxidation ditch systems in separate phases to reach a final capacity of 32.6MGD.
July 14, 2003	Grand Strand WSA	Incorporation of a Preliminary Engineering Report which outlines plans to increase the design flow at the Loris WWTF from 0.7MGD to 1.0MGD. This expanded flow could be met without modifying current water quality permit limits for this facility.
January 12, 2004	Grand Strand WSA	Incorporation of a Preliminary Engineering Report which outlines plans to rerate the treatment capacity of the Green Sea- Floyds WWTF from 10,800 GPD to 15,450 GPD. Proposal would add an additional spray field for disposal of treated effluent. A rapid sand filter would be installed to remove solids prior to chlorination.
January 12, 2004	Inlet Point South PUD	Incorporation of a Preliminary Engineering Report to relocate the existing 14,000GPD dedicated spray site to the Reserve Golf Course in Willbrook Plantation. The existing site off of Willbrook Blvd in Litchfield will be abandoned.
June 14, 2004	WRCOG	Summary of Updates/Amendments to Section 208 Plan 2003-2004.
August 9, 2004	Grand Strand WSA	Proposal to divert excess wastewater flows from the Longs WWTF to the Vereen WWTF for treatment and disposal. Proposal outlines plans to construct 21,500lf of 12in force main along SC-26-31 from SC Hwy 905 to SC Hwy 90.
November 14, 2005	Williamsburg County WSA	Incorporation of a Preliminary Engineering Report to rerate the current design flow at the Southwest Williamsburg County Regional WWTF from 0.6MGD to 0.9MGD. The facility will meet present water quality standard permit limits at the requested flow increase.
June 12, 2006	Grand Strand WSA City of Myrtle Beach	Incorporation of an agreement to transfer the ownership of the Myrtle Beach WWTF from the City of Myrtle Beach to Grand Strand WSA. Grand Strand WSA will assume responsibility to operate and maintain the facility. The City of Myrtle Beach will be redesignated as a point source management agency for wastewater collection only and will continue to maintain the wastewater collection system within its service boundary and continue billing its customers. As a result of this agreement, the Ultimate Oxygen Demand permit allocation from the Myrtle Beach WWTF will be transferred to Grand Strand WSA.
September 11, 2006	Grand Strand WSA	Incorporation of a Preliminary Engineering Report to rerate the treatment capacity at the Loris WWTF. Report concluded that facility could meet proposed effluent limits at a design flow of 1.0MGD based on organic loading, and a design flow of 1.2 MGD based on hydraulic loading.
February 11, 2008	Grand Strand WSA	Incorporation of a Preliminary Engineering Report which outlines plans to construct a new wastewater treatment facility in the Bucksport community of Horry County. The new facility would be known as the Bucksport/Tip Top Regional WWTF. This facility is designed as a land application site with a treatment capacity of 10MGD and consists of seven rapid infiltration sand basins for ultimate disposal with no discharge to nearby surface waters. The facility is intended to accommodate future flows from the Bucksport, Conway, Central/Carolina Forest, and Western Horry County planning areas.

APPENDIX M- Section 208 Water Quality Public Survey and Results

One of the main public outreach strategies employed throughout the update of the 2011 Waccamaw Region Section 208 Water Quality Plan was the administration of a public survey. The public survey was to gauge local citizens perception on water quality issues and to generate ideas on potential water resource management strategies that will help ensure the protection of the water quality throughout the Waccamaw region. Below is a summary of the responses from the survey. A copy of the survey is also provided at the end of this appendix.

This Page Has Been Left Blank Intentionally

Waccamaw Region Section 208 Water Quality Survey

Purpose: This survey will be utilized to assess public concerns related to water quality issues in the Waccamaw Region (Horry County, Georgetown County, Williamsburg County). The Waccamaw Regional Council of Governments is in the process of updating the Waccamaw Region Section 208 Water Quality Plan, as a fulfillment of the federal Clean Water Act. Your feedback during this planning process is greatly appreciated. Please provide us your thoughts by completing the following questionnaire.

Contact Information: Please mail or drop off completed survey at:

Daniel Newquist
Waccamaw Regional COG
1230 Highmarket St.
Georgetown, SC 29440

The survey can also be completed electronically and forwarded to the following email address: dnewquist@wrcog.org

Please feel free to forward any questions or comments regarding this survey or the Section 208 planning process via email at dnewquist@wrcog.org or by phone: 843-436-6131

The 1998 Waccamaw Region Section 208 Water Quality Plan can be accessed at: http://www.wrcog.org/docs/wacreg208plan.pdf

Thanks again for your participation and interest in helping to protect the quality of the water resources in the Waccamaw Region.

(1). Please rank in priority (1 through 7) the importance of the following issues in the Waccamaw Region.

Economic Development	
Water Quality	
Transportation improvements	
Air Quality	
Quality of Education (K-12)	
Resident health and wellness	
Public safety	

(2). Please evaluate the following environmental issues as they affect the Waccamaw Region.

	Major Concern	Minor Concern	Not a Concern
Air Quality			
Water Quality			
Climate Change/Sea Level Rise			
Solid Waste Management/ Recycling Programming			
Litter			
Endangered Species Protection			
Invasive Species Management			
Flood Mitigation/Management			
Drought Mitigation/Management			
Natural Disasters			
Energy Use			
Wetland and Sensitive Natural Area Conservation.			

(3). Over the last 5 years, do you think that the water quality in the Waccamaw Region has:

Improved significantly	
Improved moderately	
Stayed the same	
Degraded moderately	
Degraded significantly	
Not Sure	

(4). Please indicate how you feel regarding each of the following statements (5- Strongly Agree, 4- Agree, 3- Neutral, 2- Disagree, 1- Strongly Disagree, 9- Not Sure)

The quality of local streams and rivers near where I live affects my quality of life	
The quality of local streams and rivers near where I live affects my property value	
The quality of local streams and rivers affects the region's overall economic development efforts	
The quality of local streams, rivers, and beaches affects the region's tourism industry	

(5). Please indicate whether you believe the following household or local level pollution sources are a problem in the Waccamaw Region

	Not a Problem	Minor Problem	Major Problem	Not Sure
Pet Waste				
Lawn/ garden products (fertilizers/pesticides)				
Automotive fuel and oil leaks				
Litter/trash				
Household hazardous waste				

6). Please indicate whether you believe the following regional or watershed level pollution sources are a problem in the Waccamaw Region

	Not a Problem	Minor Problem	Major Problem	Not sure
Discharged treated effluent from wastewater treatment plants				
Discharged treated effluent from industrial sites				
Water pollution associated with urban stormwater runoff (i.e. streets, parking lots, lawns, etc.)				
Water pollution associated with agricultural runoff (Row crop)				
Water pollution associate with agricultural runoff (Livestock operation)				
Water pollution associated with forestry practices				
Septic system failures				
Water pollution from pharmaceutical contamination				

(7). How often do you engage in water based recreational activities in the Waccamaw Region during the peak outdoor season, April -October (swim at the beach/rivers, boating, fishing)?

Multiple times per week	
At least once per week	
At least once per month	
Occasionally, less than once per month	
Never	

(8). What is your level of confidence in existing state and local efforts to manage water quality?

	State	Local
Very Confident		
Somewhat Confident		
Neutral		
Somewhat Unconfident		
Very Unconfident		
Not sure		

(9). Please indicate how you feel regarding each of the following statements (5- Strongly Agree, 4- Agree, 3- Neutral, 2- Disagree, 1- Strongly Disagree, 9- Not Sure)

All water quality management entities, both local and state, are doing the best they can to manage water quality issues in the Waccamaw Region.	
Local management entities are doing the best they can to manage water quality issues, however they need more support from the state.	
Local management entities are doing the best they can to collaborate and share resources with each other to more effectively address water quality issues.	
Most members of the general public are aware of water quality issues in the Waccamaw Region.	
The general public has a full understanding of their role in water quality management efforts.	

(10) How supportive would you be if local and county governments adopted the following types of ordinances or practices to help protect water quality in the Waccamaw Region? (1- Very Supportive, 2- Somewhat Supportive, 3-Not Supportive, 9- Not Sure)

Ordinance that restricts certain land disturbing activities immediately adjacent to rivers, streams, and wetlands (i.e. riparian buffer ordinance)	
Regulations that require developers to conserve a % of open space on their developable property	
Increased restrictions on the use of on-site waste disposal systems (i.e. septic systems)	
The development of a government sponsored open space protection fund	
Adoption of a policy to institute Low Impact Development stormwater management practices for all newly constructed public buildings and facilities	

(11). Please indicate your perception regarding the level of accessibility and availability of water quality information released by state and local governments.

	State	Local
Always readily and conveniently available		
Usually available most of the time		
Adequately available		
Only available some of the time		
Rarely available the majority of the time		
Never Available		
Not Sure		

(12). Please check all sources of water quality information you have referenced or have been exposed to in the last year.

Public Meetings/ Public Hearings	
Public Workshops hosted by Coastal Carolina University, Clemson Extension, North Inlet Winyah Bay NERRS Coastal Training Program or the Coastal Waccamaw Stormwater Education Consortium.	
SC DHEC website	
EPA website	
Local Government website	
Water utility district website, pamphlets, or reports.	
Waccamaw Region Section 208 Water Quality Plan	
South Carolina 303(d) list of impaired water sites	
Other watershed reports or plans (please specify):	
Academic textbook	
Anti- pollution public service announcements (TV and radio), including anti-litter and illegal dumping campaigns.	
Anti- pollution roadside billboards including anti-litter and illegal dumping campaigns.	
Public awareness literature (flyers or brochures)	
Water quality advisory signs (i.e.- swimming advisory, shellfish harvest area closure)	
Other (please specify):	

13). Assume that the local government received a $1 million grant to make infrastructure improvements or to implement programs or projects aimed at improving water quality in your community. Indicate how you would recommend spending this money to address the following list of water quality management needs? (i.e. $200,000- Stormwater Management, $300,000- Public Education, $500,000- Wastewater Treatment Facilities, $0 for everything else)

Wastewater Treatment Facilities	
Stormwater Management	
Septic System Replacement Program	
Water Quality Monitoring Program	
Public Education Programming	
Sensitive Natural Area Protection (Conservation Easements/ Public Land Acquisition)	
Water Quality Research (i.e. salt water intrusion, emerging contaminants)	
Remediation project for existing water quality problem	
Project to focus on the area beaches	
Project to focus on shellfish harvesting areas	
Project to focus on Mercury contamination in aquatic fish species	
Other (please specify):	

14). Which County do you currently live in?

Horry County	
Georgetown County	
Williamsburg County	
Other (Please Specify):	

(15). How long have you lived in the Waccamaw Region (Horry, Georgetown, or Williamsburg Counties)?

Less than 2 years	
2-5 years	
6-10 years	
11-20 years	
More than 20 years	
Not Applicable	

(16). Are you a part-time or full-time resident of the Waccamaw Region?

Part-time	
Full-time	
Not Applicable	

(17). How close do you live to a stream, river, or the beach?

Less than ¼ mile	
Between ¼ and 1 mile	
Between 1-2 miles	
Between 2-5 miles	
More than 5 miles	
Not Sure	

(18). What watershed do you live in?

Waccamaw River	
Coastal/ Atlantic Intracoastal Waterway	
Little Pee Dee River	
Great Pee Dee River	
Black River	
Lumber River	
Lynches River	
Sampit River	
Santee River	
Other (Please Specify):	

(19). Please indicate your age:

Under 20 years old	
20-29 years old	
30-39 years old	
40-49 years old	
50-59 years old	
60-69 years old	
70-79 years old	
80 years and older	

COMMENTS:

Waccamaw Region Section 208 Water Quality Survey

Purpose: This survey will be utilized to assess public concerns related to water quality issues in the Waccamaw Region (Horry County, Georgetown County, Williamsburg County). The Waccamaw Regional Council of Governments is in the process of updating the Waccamaw Region Section 208 Water Quality Plan, as a fulfillment of the federal Clean Water Act. Your feedback during this planning process is greatly appreciated. Please provide us your thoughts by completing the following questionnaire.

Contact Information: Please mail or drop off completed survey at:

Daniel Newquist
Waccamaw Regional COG
1230 Highmarket St.
Georgetown, SC 29440

The survey can also be completed electronically and forwarded to the following email address: dnewquist@wrcog.org

Please feel free to forward any questions or comments regarding this survey or the Section 208 planning process via email at dnewquist@wrcog.org or by phone: 843-436-6131

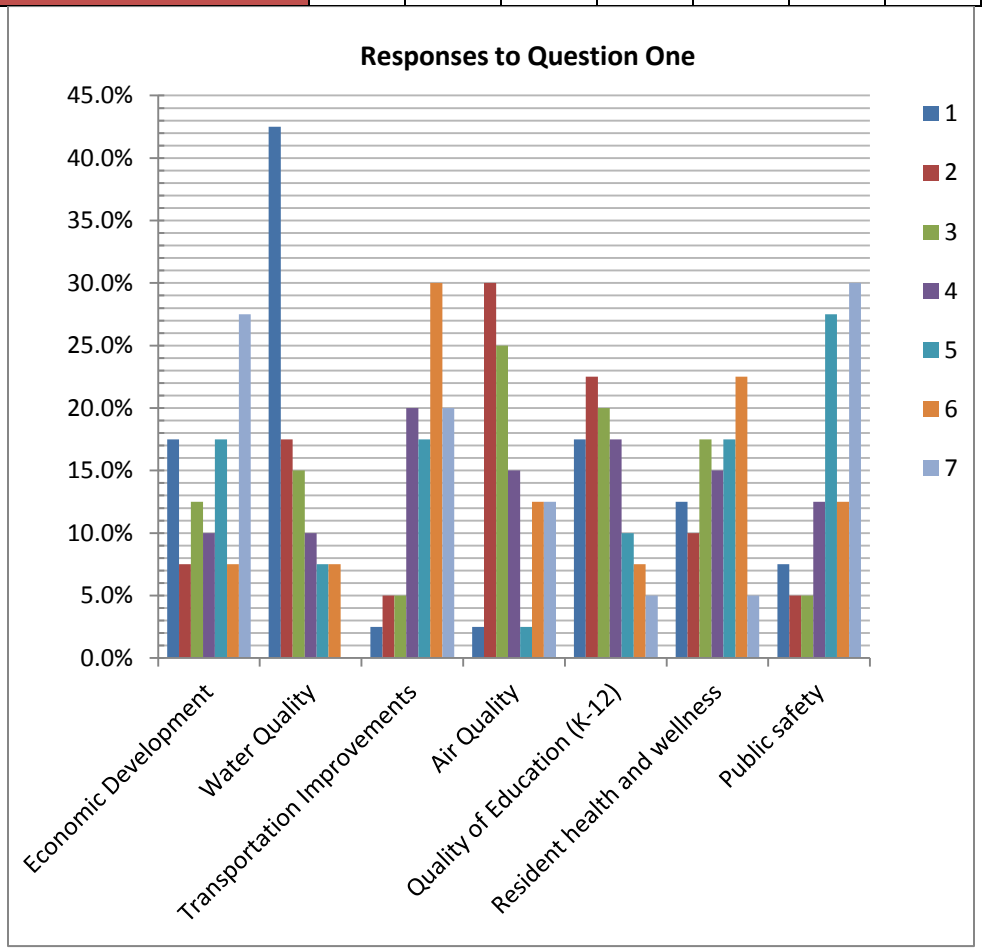
The 1998 Waccamaw Region Section 208 Water Quality Plan can be accessed at: http://www.wrcog.org/files/wacreg208plan.pdf

Thanks again for your participation and interest in helping to protect the quality of the water resources in the Waccamaw Region.

NOTE: There were 40 total surveys completed and returned.

(1). Please rank in priority (1 through 7) the importance of the following issues in the Waccamaw Region.

	1	2	3	4	5	6	7
Economic Development	17.5%	7.5%	12.5%	10.0%	17.5%	7.5%	27.5%
Water Quality	42.5%	17.5%	15.0%	10.0%	7.5%	7.5%	0.0%
Transportation improvements	2.5%	5.0%	5.0%	20.0%	17.5%	30.0%	20.0%
Air Quality	2.5%	30.0%	25.0%	15.0%	2.5%	12.5%	12.5%
Quality of Education (K-12)	17.5%	22.5%	20.0%	17.5%	10.0%	7.5%	5.0%
Resident health and wellness	12.5%	10.0%	17.5%	15.0%	17.5%	22.5%	5.0%
Public safety	7.5%	5.0%	5.0%	12.5%	27.5%	12.5%	30.0%



(2). Please evaluate the following environmental issues as they affect the Waccamaw Region.

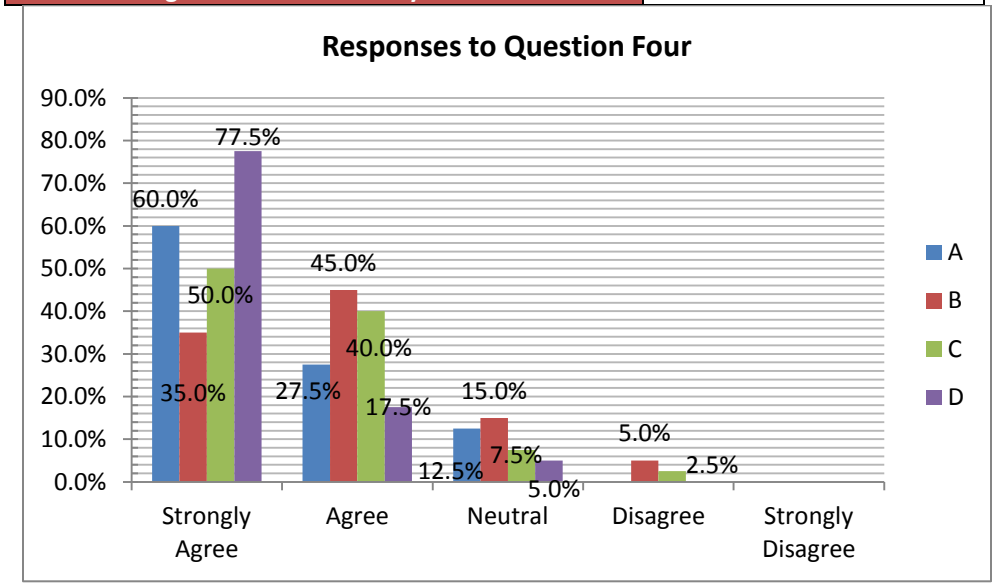
	Major Concern	Minor Concern	Not a Concern
Air Quality	57.5%	42.5%	0.0%
Water Quality	82.5%	17.5%	0.0%
Climate Change/Sea Level Rise	55.0%	37.5%	7.5%
Solid Waste Management/ Recycling Programming	62.5%	35.0%	2.5%
Litter	55.0%	40.0%	2.5%
Endangered Species Protection	47.5%	37.5%	10.0%
Invasive Species Management	55.0%	40.0%	5.0%
Flood Mitigation/Management	56.4%	41.0%	2.6%
Drought Mitigation/Management	42.1%	52.6%	5.3%
Natural Disasters	57.9%	39.5%	2.6%
Energy Use	65.8%	28.9%	5.3%
Wetland and Sensitive Natural Area Conservation.	84.6%	15.4%	0.0%

(3). Over the last 5 years, do you think that the water quality in the Waccamaw Region has:

Improved significantly	0.0%
Improved moderately	20.0%
Stayed the same	30.0%
Degraded moderately	37.5%
Degraded significantly	2.5%
Not Sure	10.0%

(4). Please indicate how you feel regarding each of the following statements (5- Strongly Agree, 4- Agree, 3- Neutral, 2- Disagree, 1- Strongly Disagree, 9- Not Sure)

The quality of local streams and rivers near where I live affects my quality of life	**A** in graph below
The quality of local streams and rivers near where I live affects my property value	**B** in graph below
The quality of local streams and rivers affects the region's overall economic development efforts	**C** in graph below
The quality of local streams, rivers, and beaches affects the region's tourism industry	**D** in graph below



(5). Please indicate whether you believe the following household or local level pollution sources are a problem in the Waccamaw Region

	Not a Problem	Minor Problem	Major Problem	Not Sure
Pet Waste	5.0%	32.5%	62.5%	0.0%
Lawn/ garden products (fertilizers/pesticides)	5.0%	17.5%	75.0%	2.5%
Automotive fuel and oil leaks	2.6%	47.4%	42.1%	7.9%
Litter/trash	0.0%	32.5%	67.5%	0.0%
Household hazardous waste	2.5%	47.5%	35.0%	15.0%

(6). Please indicate whether you believe the following regional or watershed level pollution sources are a problem in the Waccamaw Region

	Not a Problem	Minor Problem	Major Problem	Not sure
Discharged treated effluent from wastewater treatment plants	12.8%	41.0%	35.9%	10.3%
2.5%	2.5%	30.0%	57.5%	10.0%
Water pollution associated with urban stormwater runoff (i.e. streets, parking lots, lawns, etc.)	0.0%	10.0%	87.5%	2.5%
Water pollution associated with agricultural runoff (Row crop)	5.0%	45.0%	37.5%	12.5%
Water pollution associate with agricultural runoff (Livestock operation)	2.6%	43.6%	41.0%	12.8%
Water pollution associated with forestry practices	12.5%	50.0%	22.5%	15.0%
Septic system failures	0.0%	30.0%	62.5%	7.5%
Water pollution from pharmaceutical contamination	10.5%	47.4%	26.3%	15.8%

(7). How often do you engage in water based recreational activities in the Waccamaw Region during the peak outdoor season, April -October (swim at the beach/rivers, boating, fishing)?

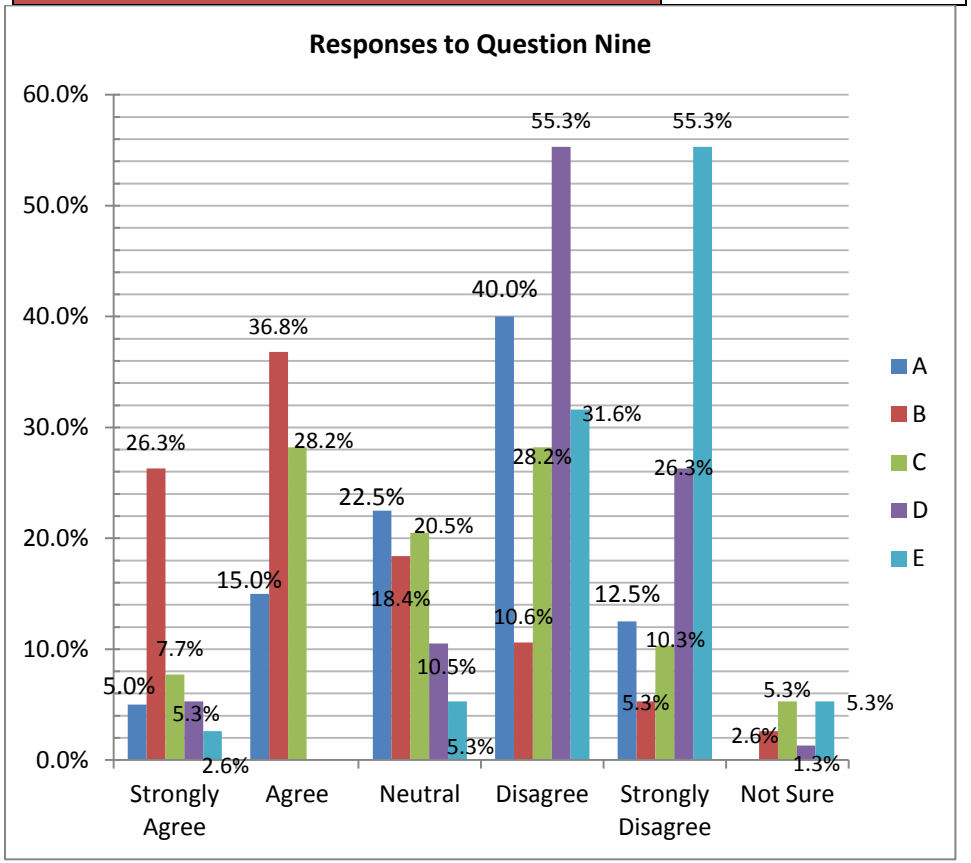
Multiple times per week	22.5%
At least once per week	32.5%
At least once per month	17.0%
Occasionally, less than once per month	22.5%
Never	5.0%

(8). What is your level of confidence in existing state and local efforts to manage water quality?

	State	Local
Very Confident	2.5%	5.4%
Somewhat Confident	22.5%	35.2%
Neutral	12.5%	5.4%
Somewhat Unconfident	40.0%	21.6%
Very Unconfident	22.5%	32.4%
Not sure	0.0%	0.0%

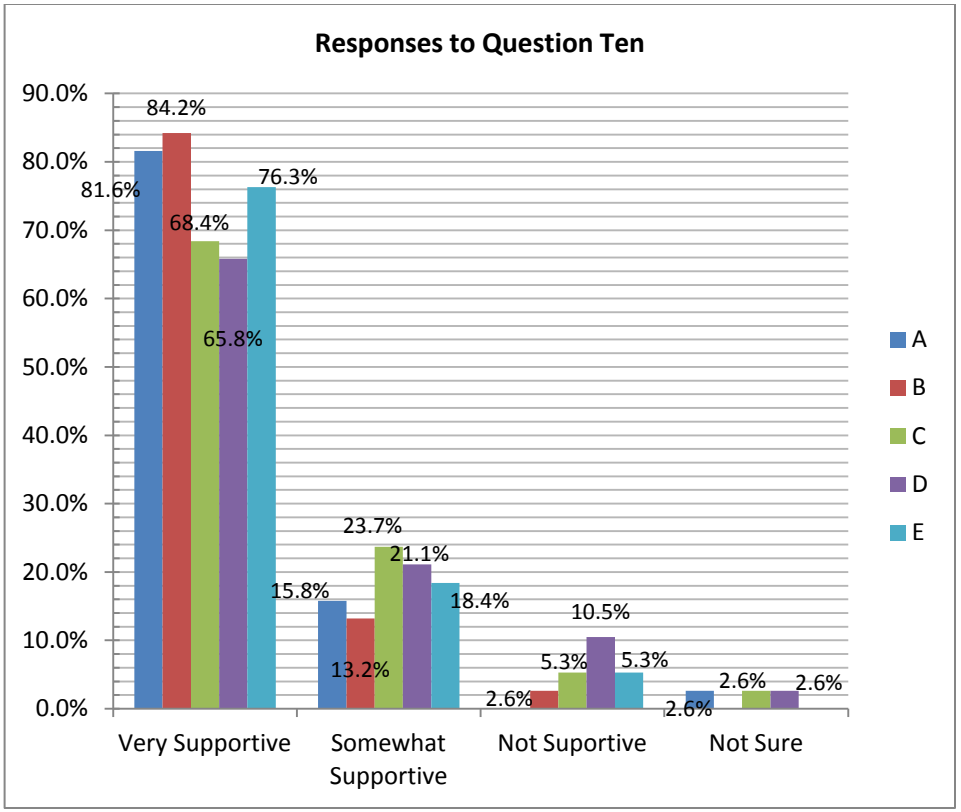
(9). Please indicate how you feel regarding each of the following statements (5- Strongly Agree, 4- Agree, 3- Neutral, 2- Disagree, 1- Strongly Disagree, 9- Not Sure)

All water quality management entities, both local and state, are doing the best they can to manage water quality issues in the Waccamaw Region.	**A** in graph below
Local management entities are doing the best they can to manage water quality issues, however they need more support from the state.	**B** in graph below
Local management entities are doing the best they can to collaborate and share resources with each other to more effectively address water quality issues.	**C** in graph below
Most members of the general public are aware of water quality issues in the Waccamaw Region.	**D** in graph below
The general public has a full understanding of their role in water quality management efforts.	**E** in graph below



(10) How supportive would you be if local and county governments adopted the following types of ordinances or practices to help protect water quality in the Waccamaw Region? (1- Very Supportive, 2- Somewhat Supportive, 3-Not Supportive, 9- Not Sure)

Ordinance that restricts certain land disturbing activities immediately adjacent to rivers, streams, and wetlands (i.e. riparian buffer ordinance)	**A** in graph below
Regulations that require developers to conserve a % of open space on their developable property	**B** in graph below
Increased restrictions on the use of on-site waste disposal systems (i.e. septic systems)	**C** in graph below
The development of a government sponsored open space protection fund	**D** in graph below
Adoption of a policy to institute Low Impact Development stormwater management practices for all newly constructed public buildings and facilities	**E** in graph below



(11). Please indicate your perception regarding the level of accessibility and availability of water quality information released by state and local governments.

	State	Local
Always readily and conveniently available	2.7%	5.6%
Usually available most of the time	2.7%	8.3%
Adequately available	35.1%	30.6%
Only available some of the time	21.6%	36.1%
Rarely available the majority of the time	21.6%	11.1%
Never Available	0.0%	0.0%
Not Sure	16.2%	8.3%

(12). Please check all sources of water quality information you have referenced or have been exposed to in the last year.

Public Meetings/ Public Hearings	57.5%
Public Workshops hosted by Coastal Carolina University, Clemson Extension, North Inlet Winyah Bay NERRS Coastal Training Program or the Coastal Waccamaw Stormwater Education Consortium.	57.5%
SC DHEC website	47.5%
EPA website	37.5%
Local Government website	30.0%
Water utility district website, pamphlets, or reports.	35.0%
Waccamaw Region Section 208 Water Quality Plan	42.5%
South Carolina 303(d) list of impaired water sites	37.5%
Other watershed reports or plans (please specify):	10.0%
Academic textbook	15.0%
Anti- pollution public service announcements (TV and radio), including anti-litter and illegal dumping campaigns.	47.5%
Anti- pollution roadside billboards including anti-litter and illegal dumping campaigns.	40.0%
Public awareness literature (flyers or brochures)	45.0%
Water quality advisory signs (i.e.- swimming advisory, shellfish harvest area closure)	60.0%
Other (please specify):	10.0%

(13). Assume that the local government received a $1 million grant to make infrastructure improvements or to implement programs or projects aimed at improving water quality in your community. Indicate how you would recommend spending this money to address the following list of water quality management needs? (i.e. $200,000- Stormwater Management, $300,000- Public Education, $500,000- Wastewater Treatment Facilities, $0 for everything else)

Total $ amounts in each category represent the accumulated allocation of funding from the 38 question respondents.

Wastewater Treatment Facilities	$2,800,000
Stormwater Management	$5,450,000
Septic System Replacement Program	$3,325,000
Water Quality Monitoring Program	$3,245,000
Public Education Programming	$3,425,000
Sensitive Natural Area Protection (Conservation Easements/ Public Land Acquisition)	$5,450,000
Water Quality Research (i.e. salt water intrusion, emerging contaminants)	$2,375,000
Remediation project for existing water quality problem	$4,100,000
Project to focus on the area beaches	$2,050,000
Project to focus on shellfish harvesting areas	$2,075,000
Project to focus on Mercury contamination in aquatic fish species	$2,600,000
Other (please specify):	$125,000 (Water recreation vessel, i.e. jet ski, pollution control

(14). Which County do you currently live in?

Horry County	35.9%
Georgetown County	46.1%
Williamsburg County	12.8%
Other (Please Specify):	5.1%

(15). How long have you lived in the Waccamaw Region (Horry, Georgetown, or Williamsburg Counties)?

Less than 2 years	5.0%
2-5 years	5.0%
6-10 years	15.0%
11-20 years	35.0%
More than 20 years	37.5%
Not Applicable	2.5%

(16). Are you a part-time or full-time resident of the Waccamaw Region?

Part-time	7.5%
Full-time	87.5%
Not Applicable	5.0%

(17). How close do you live to a stream, river, or the beach?

Less than ¼ mile	45.0%
Between ¼ and 1 mile	20.0%
Between 1-2 miles	17.5%
Between 2-5 miles	15.0%
More than 5 miles	2.5%
Not Sure	0.0%

(18). What watershed do you live in?

Waccamaw River	44.7%
Coastal/ Atlantic Intracoastal Waterway	13.1%
Little Pee Dee River	0.0%
Great Pee Dee River	5.2%
Black River	23.7%
Lumber River	0.0%
Lynches River	0.0%
Sampit River	10.5%
Santee River	0.0%
Other (Please Specify):	2.6% Murrells Inlet

(19). Please indicate your age:

Under 20 years old	0.0%
20-29 years old	2.6%
30-39 years old	5.3%
40-49 years old	22.2%
50-59 years old	22.2%
60-69 years old	25.0%
70-79 years old	30.6%
80 years and older	0.0%

COMMENTS:

- Grant funds should be used for efforts for which no or little funds are typically available. Ratepayers should shoulder the burden of other long-term capital projects to improve water quality.
- Discharge of even treated waste into Waccamaw River should not be permitted. Frequent droughts cause higher intrusion of salt water up the river. The Pawleys Island intake water inlet for lower Waccamaw Neck residents can and has been closed due to past droughts. Now we have to worry about salt water mixed with Debordieu's wastewater. Big problem
- Local and state governments are spineless in doing anything substantial for water quality. Water quality is a land use issue and must be dealt with significant governance
- Used to live less than 1 mile from Cannie Branch but it has been disrupted by industry sills and development.

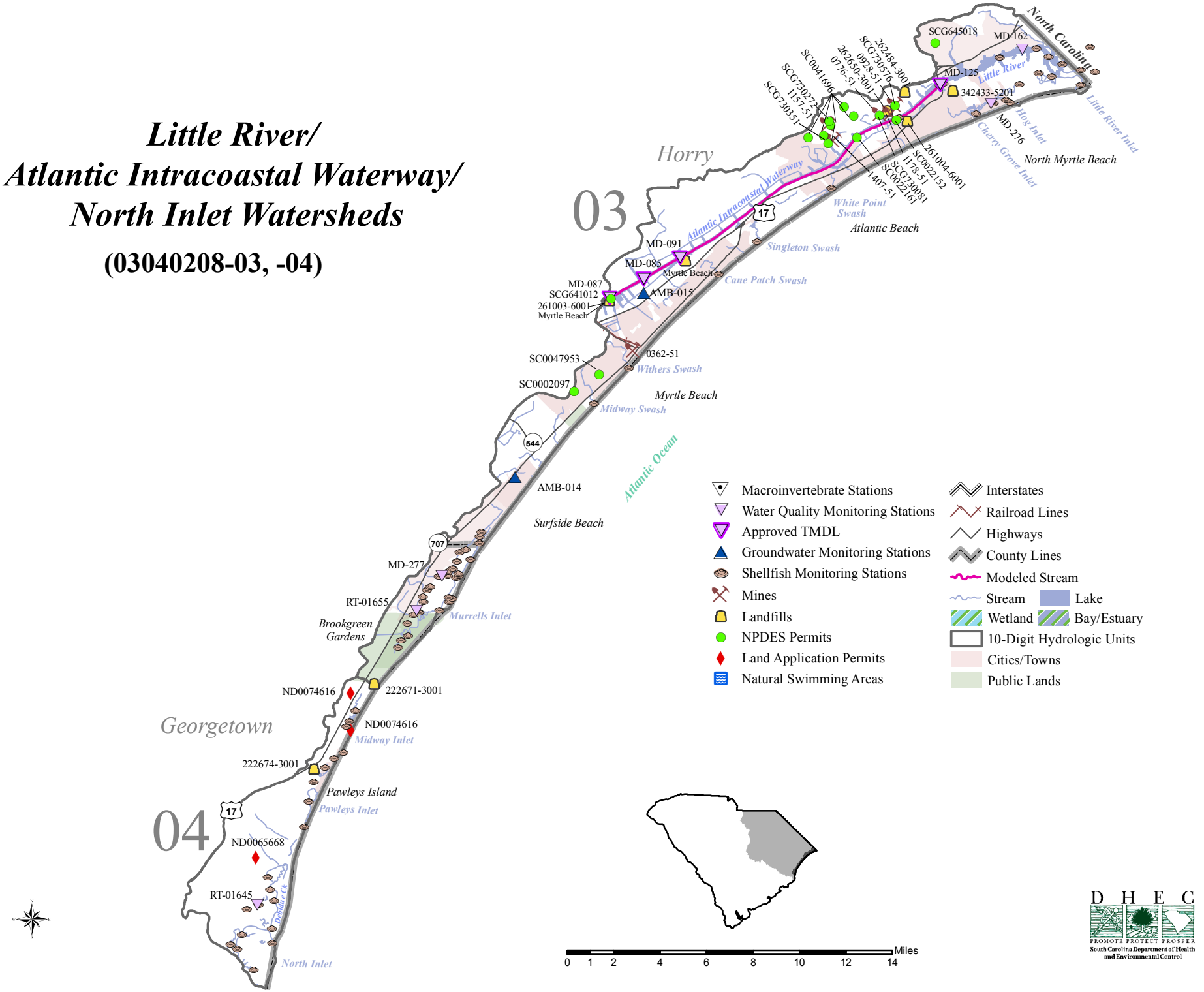
APPENDIX N- Watershed Maps, Yadkin Pee Dee and Santee River Basins

This appendix includes maps for each of the watersheds that traverse the three county Waccamaw region profiled in **Chapter Three, Watershed Assessment.** This set of watershed maps are derived from the *Pee Dee River Basin Watershed Water Quality Assessment* adopted in 2007 and the *Santee River Basin Watershed Water Quality Assessment* adopted in 2005 by SC DHEC. These are the most recent version of each respective watershed assessment, therefore each map is intended for reference purposes only. Reference information such as water monitoring station locations are subject to change depending on available funding, SC DHEC Ambient Surface Monitoring Program annual priorities, etc.

This Page Has Been Left Blank Intentionally

Little River/ Atlantic Intracoastal Waterway/ North Inlet Watersheds

(03040208-03, -04)



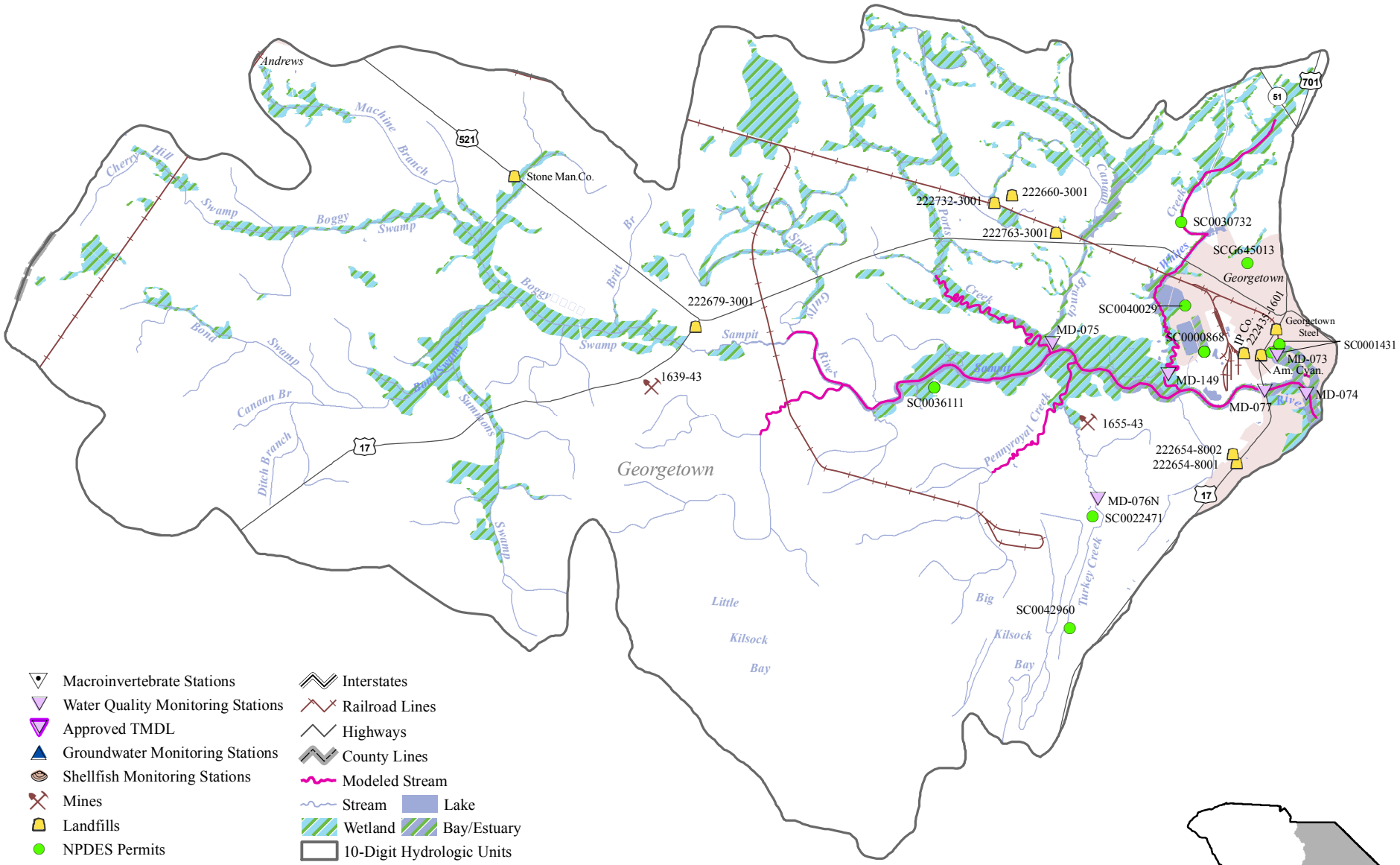
D H E C

PROMOTE PROTECT PROSPER

South Carolina Department of Health and Environmental Control

Sampit River Watershed

(03040207-01)

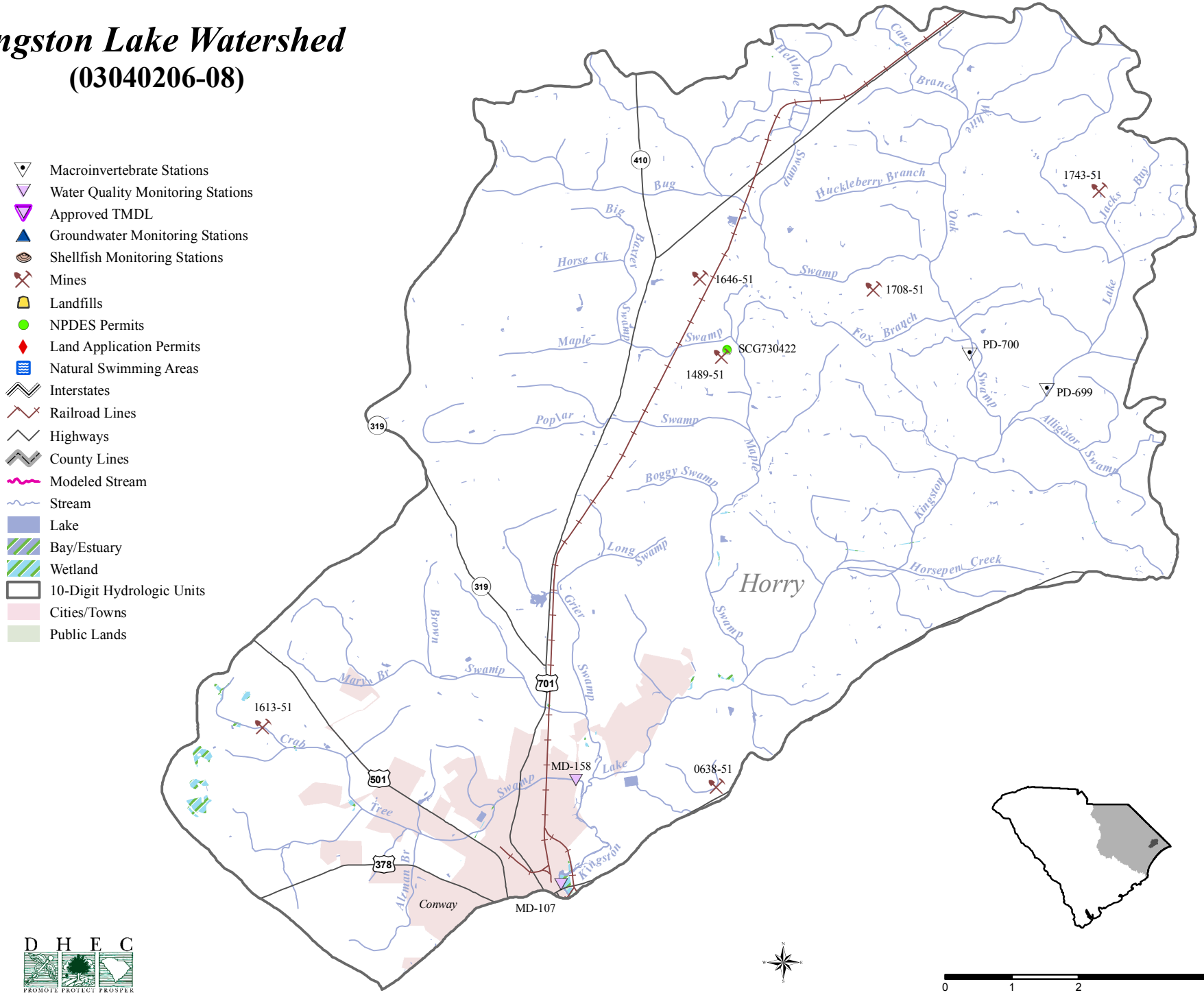


- Macroinvertebrate Stations
- Water Quality Monitoring Stations
- Approved TMDL
- Groundwater Monitoring Stations
- Shellfish Monitoring Stations
- Mines
- Landfills
- NPDES Permits
- Land Application Permits
- Natural Swimming Areas
- Interstates
- Railroad Lines
- Highways
- County Lines
- Modeled Stream
- Stream
- Lake
- Wetland
- Bay/Estuary
- 10-Digit Hydrologic Units
- Cities/Towns
- Public Lands

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

0 1 2 4 Miles

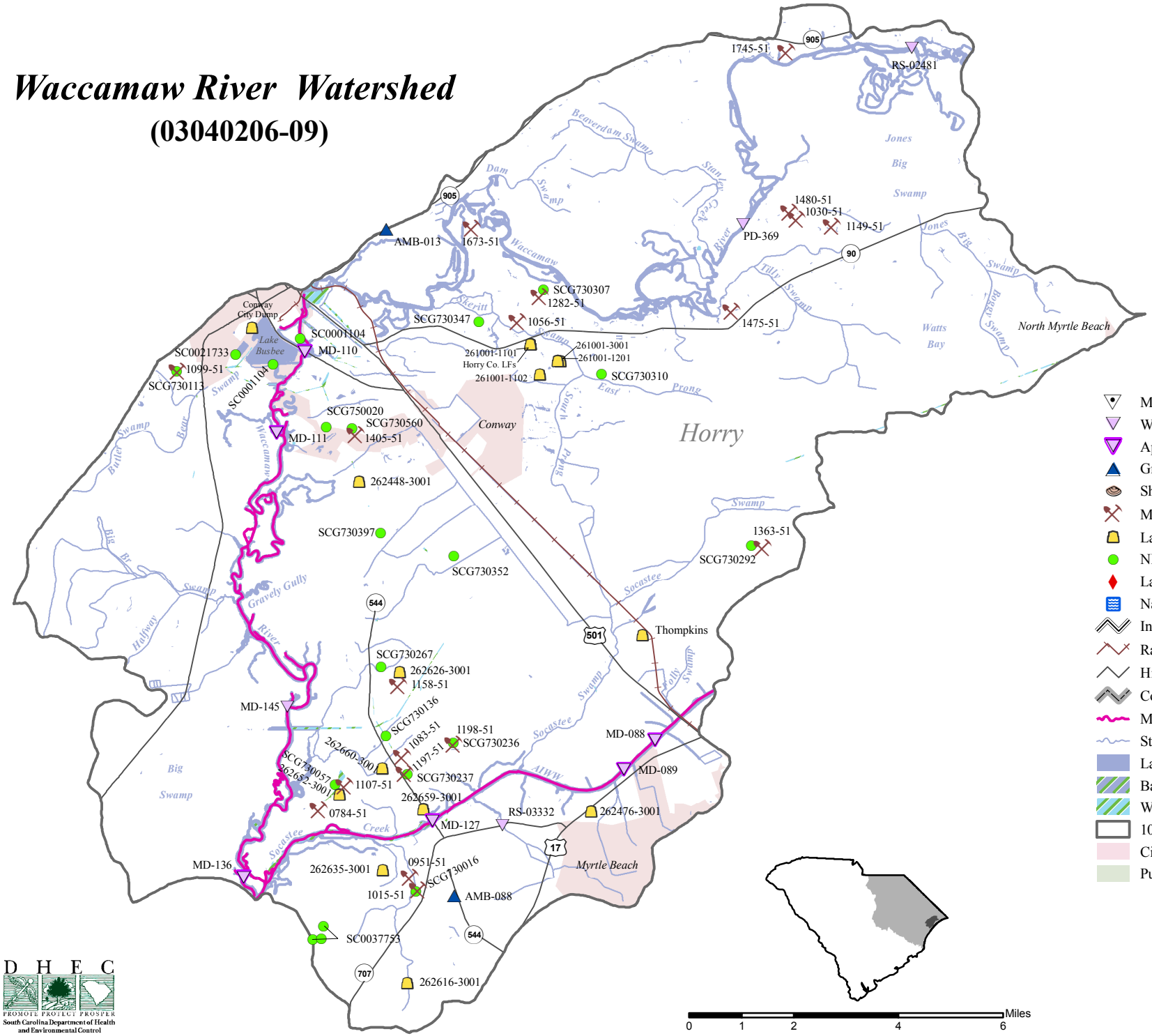
Kingston Lake Watershed
(03040206-08)



D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

Waccamaw River Watershed

(03040206-09)



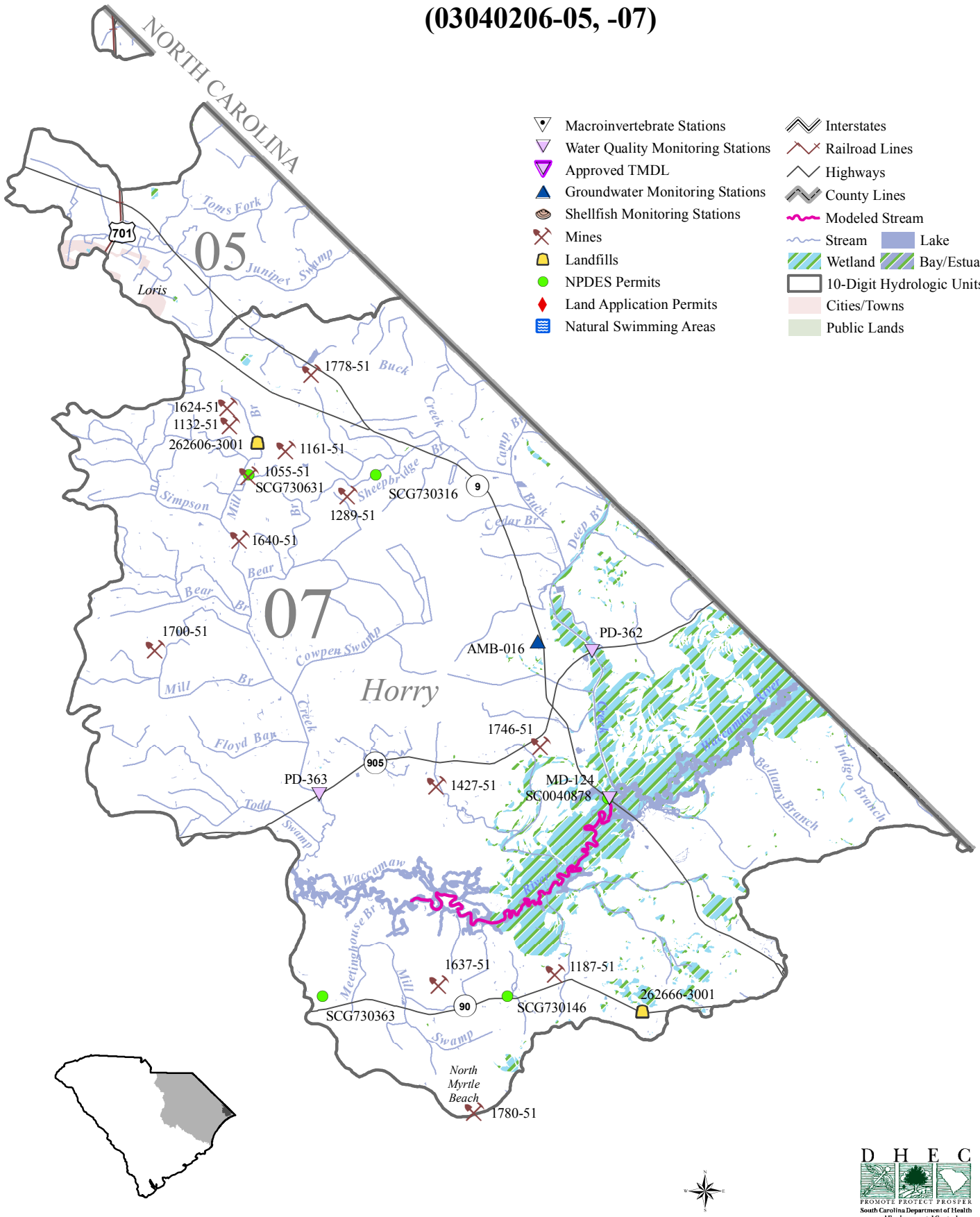
D H E C

PROMOTE PROTECT PROSPER

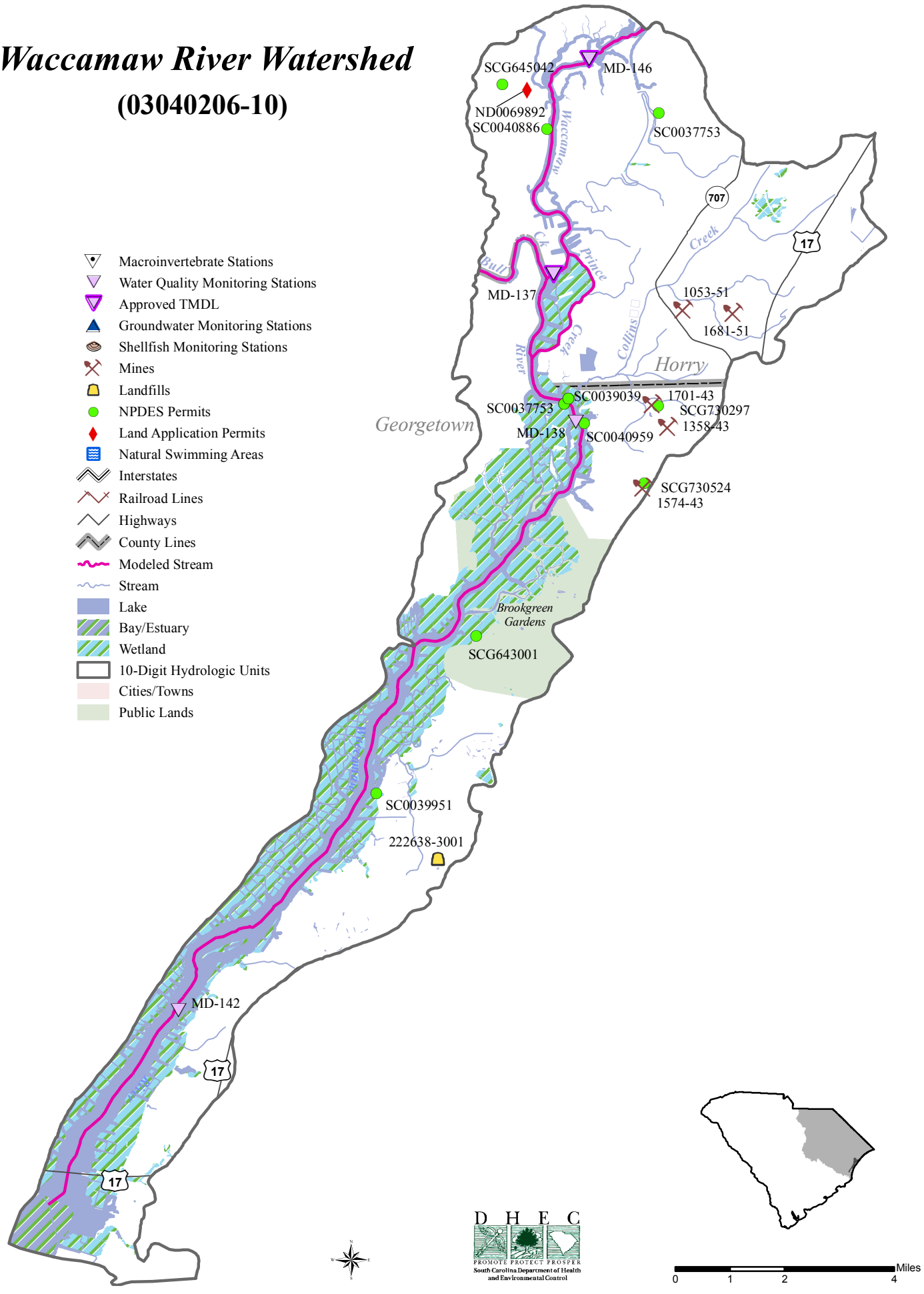
South Carolina Department of Health and Environmental Control

Waccamaw River Watersheds

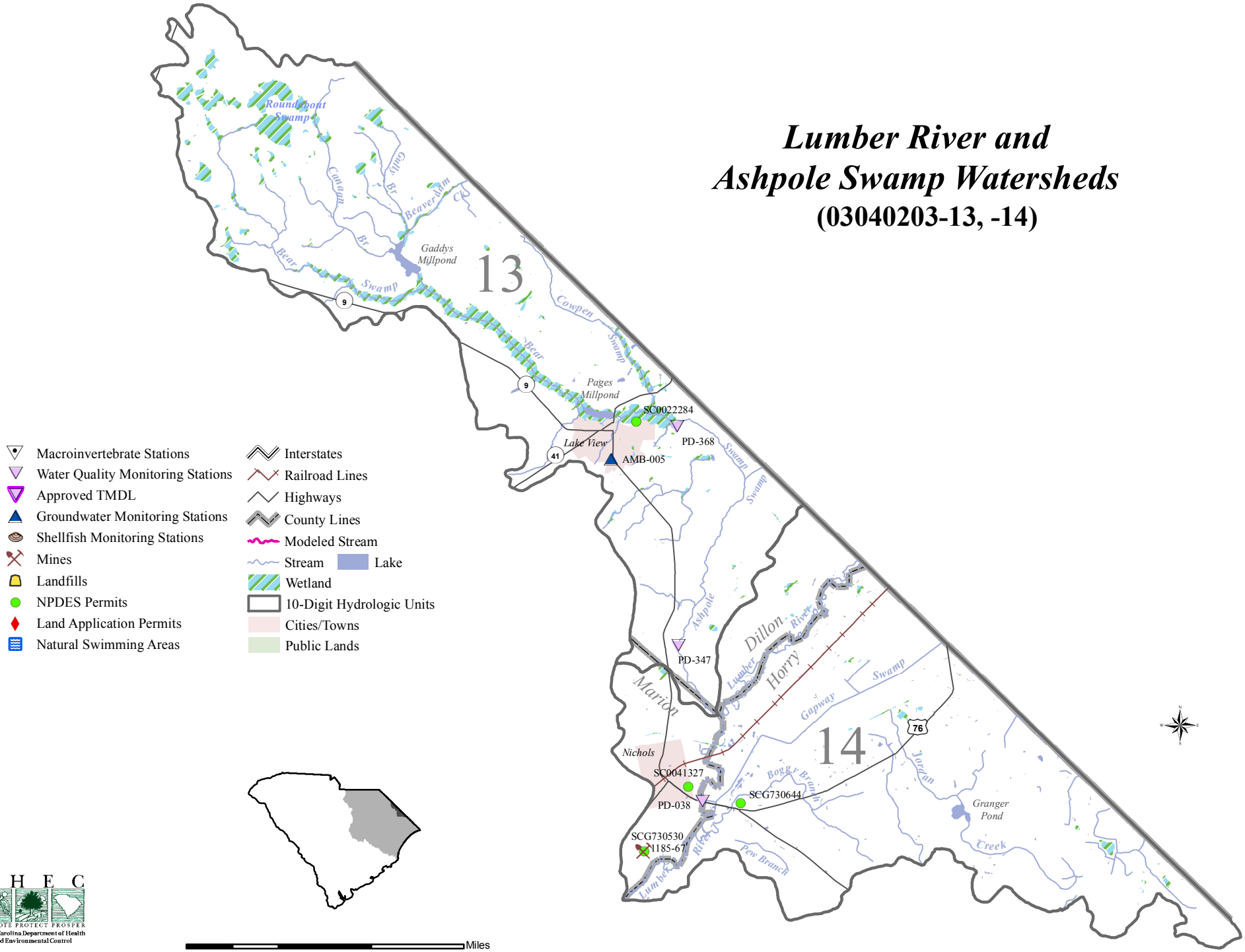
(03040206-05, -07)



Waccamaw River Watershed
(03040206-10)



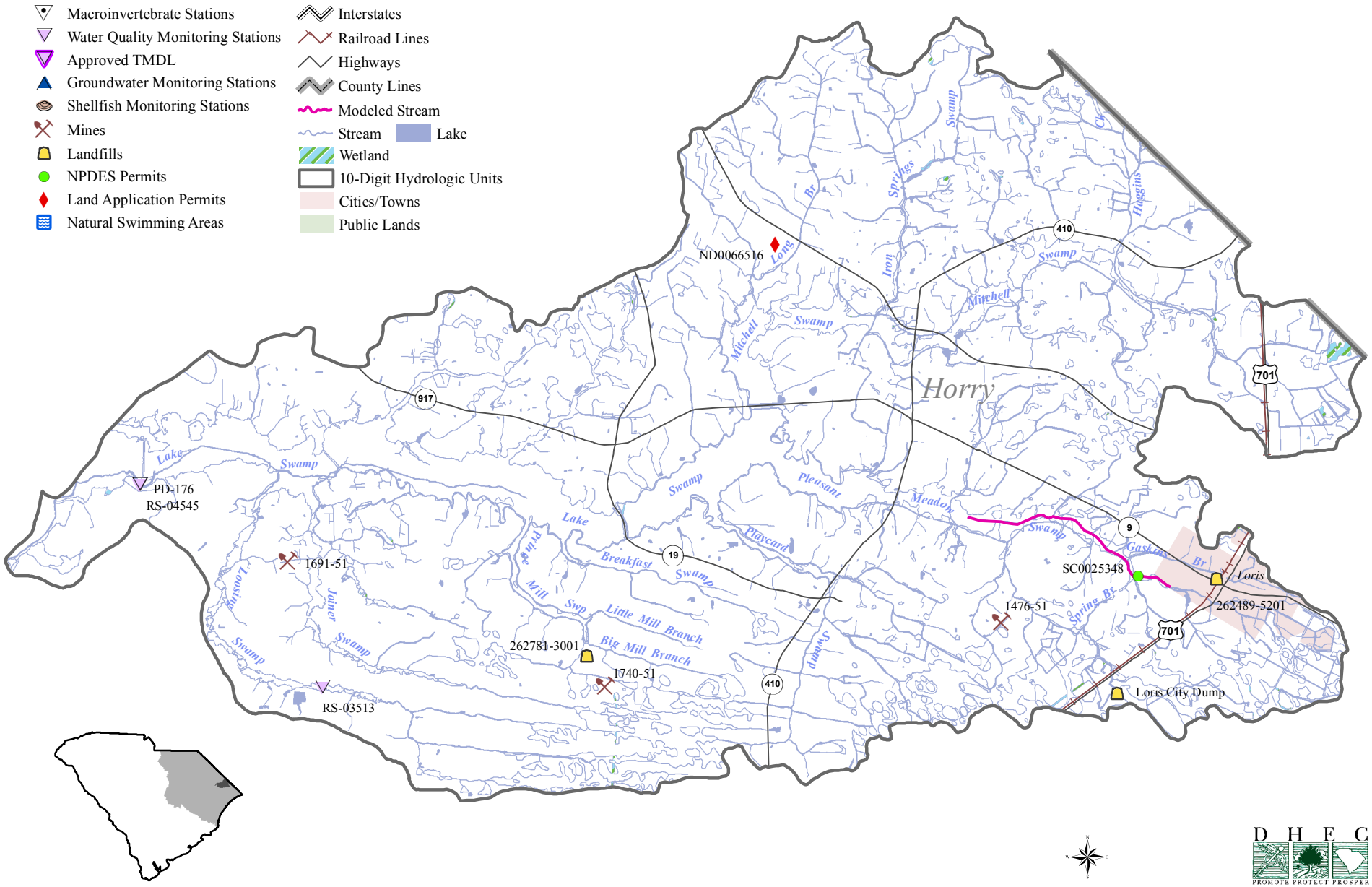
Lumber River and Ashpole Swamp Watersheds
(03040203-13, -14)

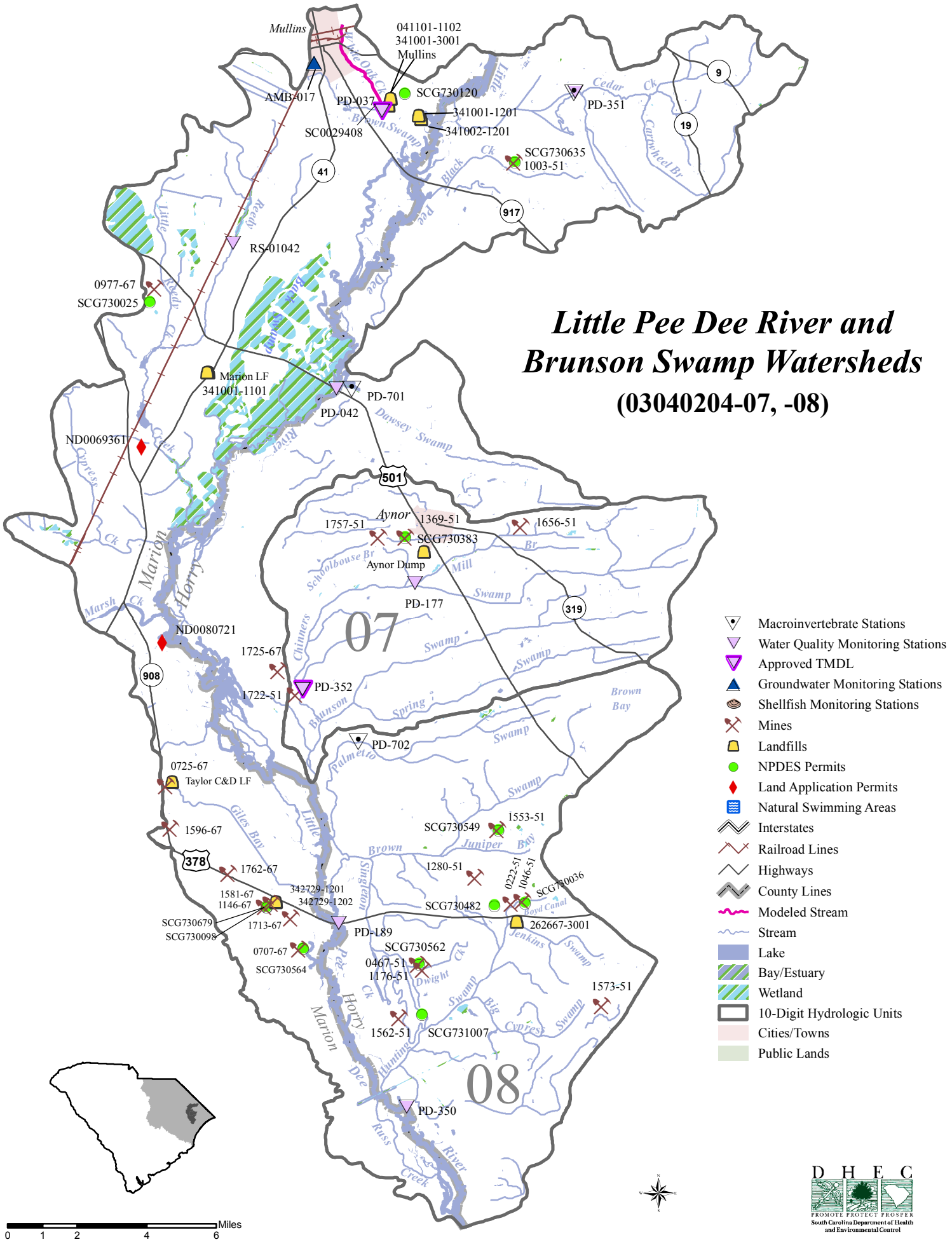


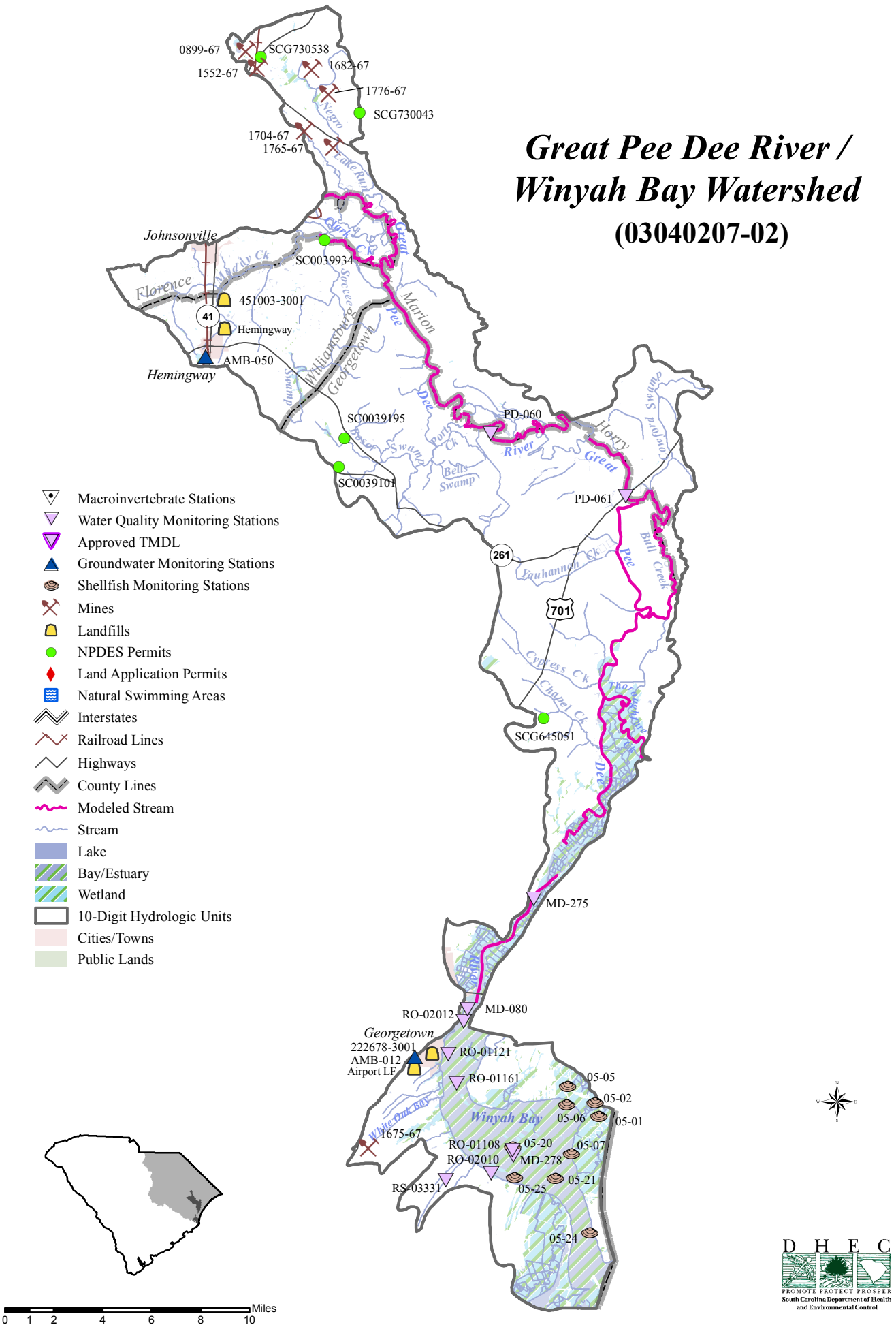
D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

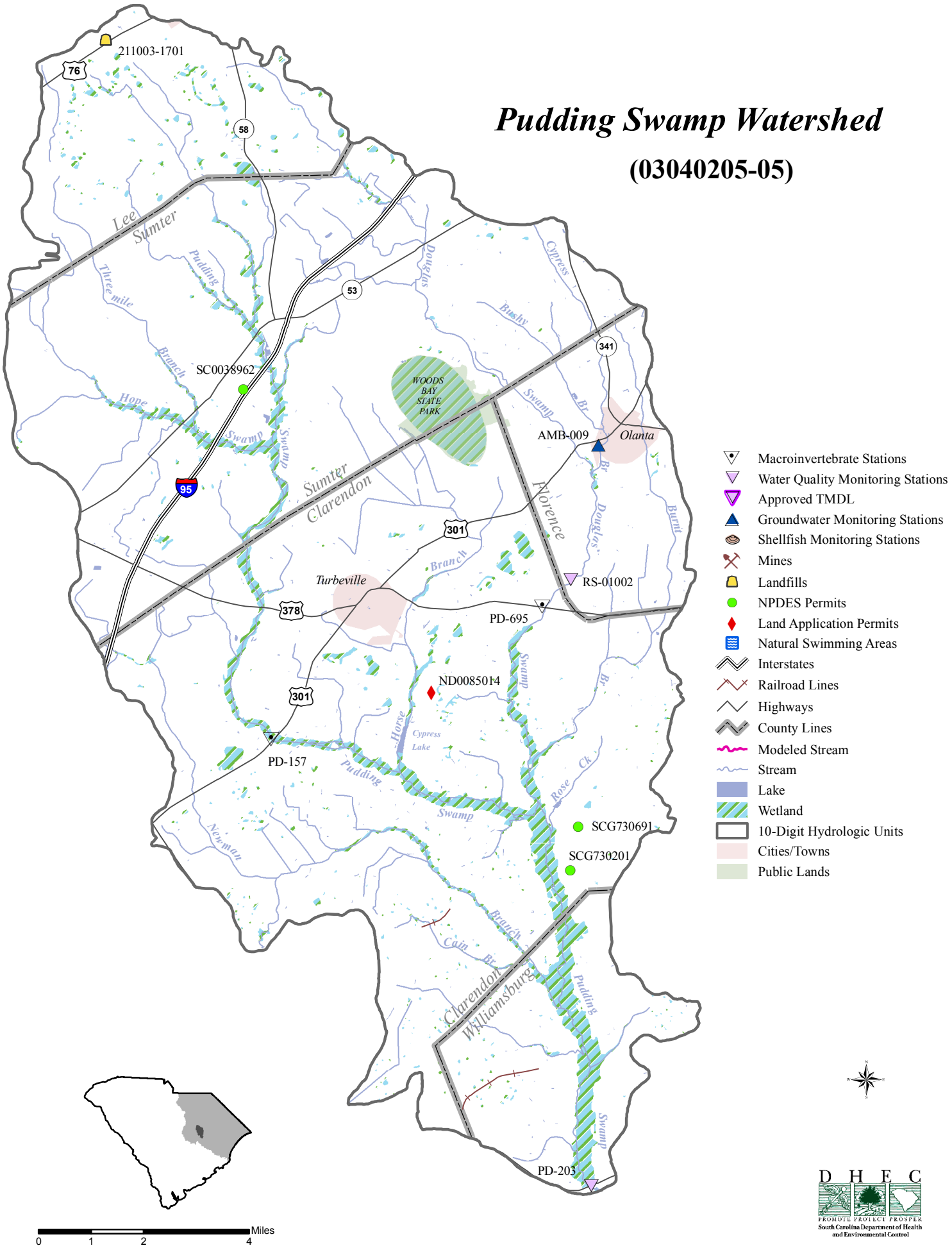
Lake Swamp Watershed

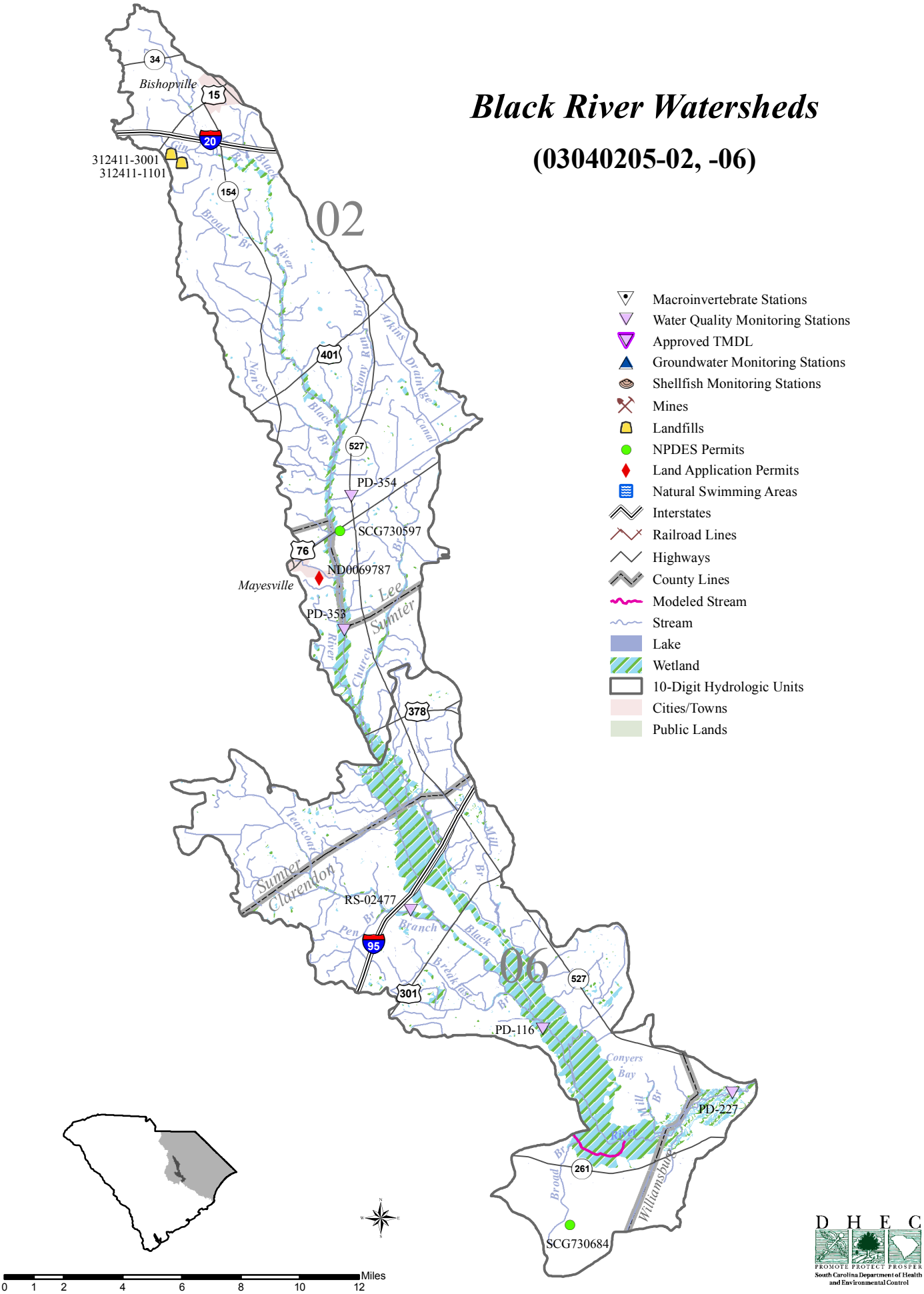
(03040204-06)

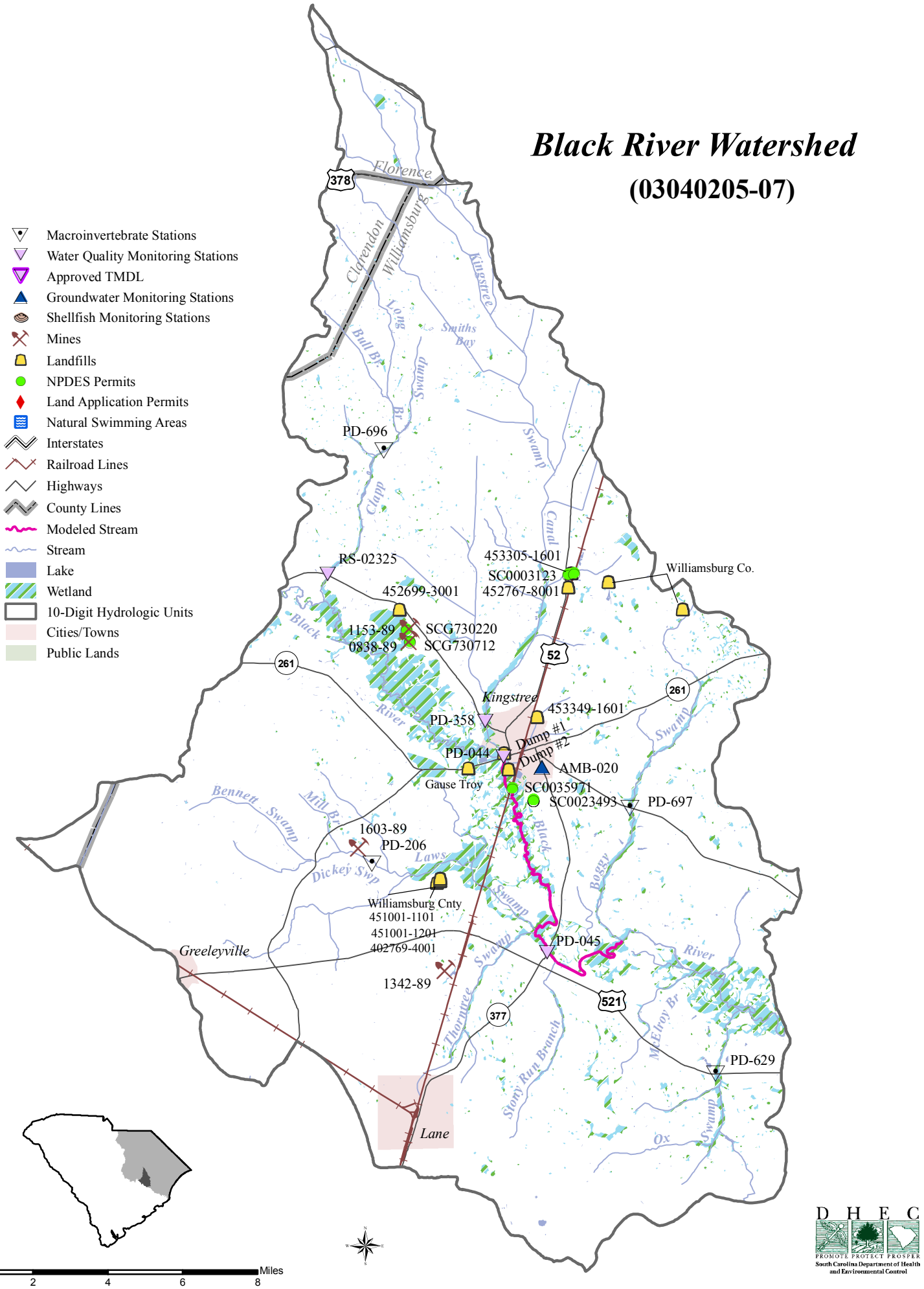


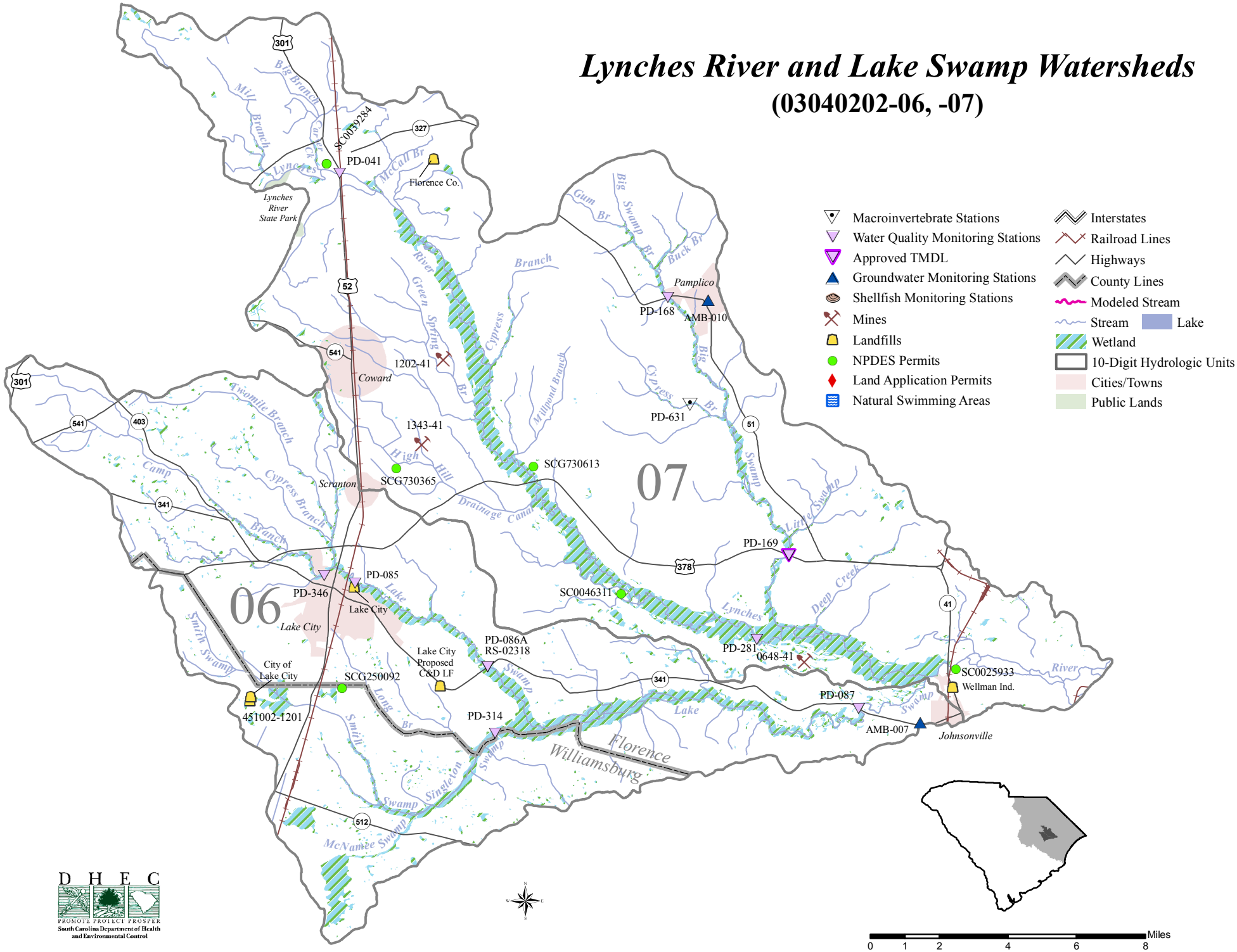

Little Pee Dee River and Brunson Swamp Watersheds
(03040204-07, -08)
Mullins
041101-1102
341001-3001
Mullins
AMB-017
PD-037
SC0029408
SCG730120
341001-1201
341002-1201
PD-351
SCG730635
1003-51
RS-01042
0977-67
SCG730025
Marion LF
341001-1101
PD-701
PD-042
ND0069361
Aynor
1757-51
1369-51
SCG730383
1656-51
Aynor Dump
PD-177
07
ND0080721
1725-67
1722-51
PD-352
PD-702
0725-67
Taylor C&D LF
1596-67
1762-67
342729-1201
342729-1202
1581-67
1146-67
1713-67
SCG730679
SCG730098
0707-67
SCG730564
PD-189
SCG730562
0467-51
1176-51
1562-51
SCG731007
1573-51
08
PD-350
1553-51
SCG730549
1280-51
0222-51
1046-51
SCG730036
SCG730482
262667-3001
Little Pee Dee River
Brunson Swamp
Dawsey Swamp
Brown Bay
Juniper Bay
Boyd Canal
Jenkins Swamp
Big Cypress Swamp
Dwight Swamp
Hunting Creek
Russ Creek
Giles Bay
Marsh Ck
Cypress Ck
Schoolbouse Br
Mill Swamp
Chinners Swamp
Spring Swamp
Palmetto Swamp
Singleton Swamp
Black Ck
Cedar Ck
Carriwheel Br
Br
Marion
Horry
501
319
908
378
41
917
19
9
Macroinvertebrate Stations
Water Quality Monitoring Stations
Approved TMDL
Groundwater Monitoring Stations
Shellfish Monitoring Stations
Mines
Landfills
NPDES Permits
Land Application Permits
Natural Swimming Areas
Interstates
Railroad Lines
Highways
County Lines
Modeled Stream
Stream
Lake
Bay/Estuary
Wetland
10-Digit Hydrologic Units
Cities/Towns
Public Lands
0 1 2 4 6 Miles
D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

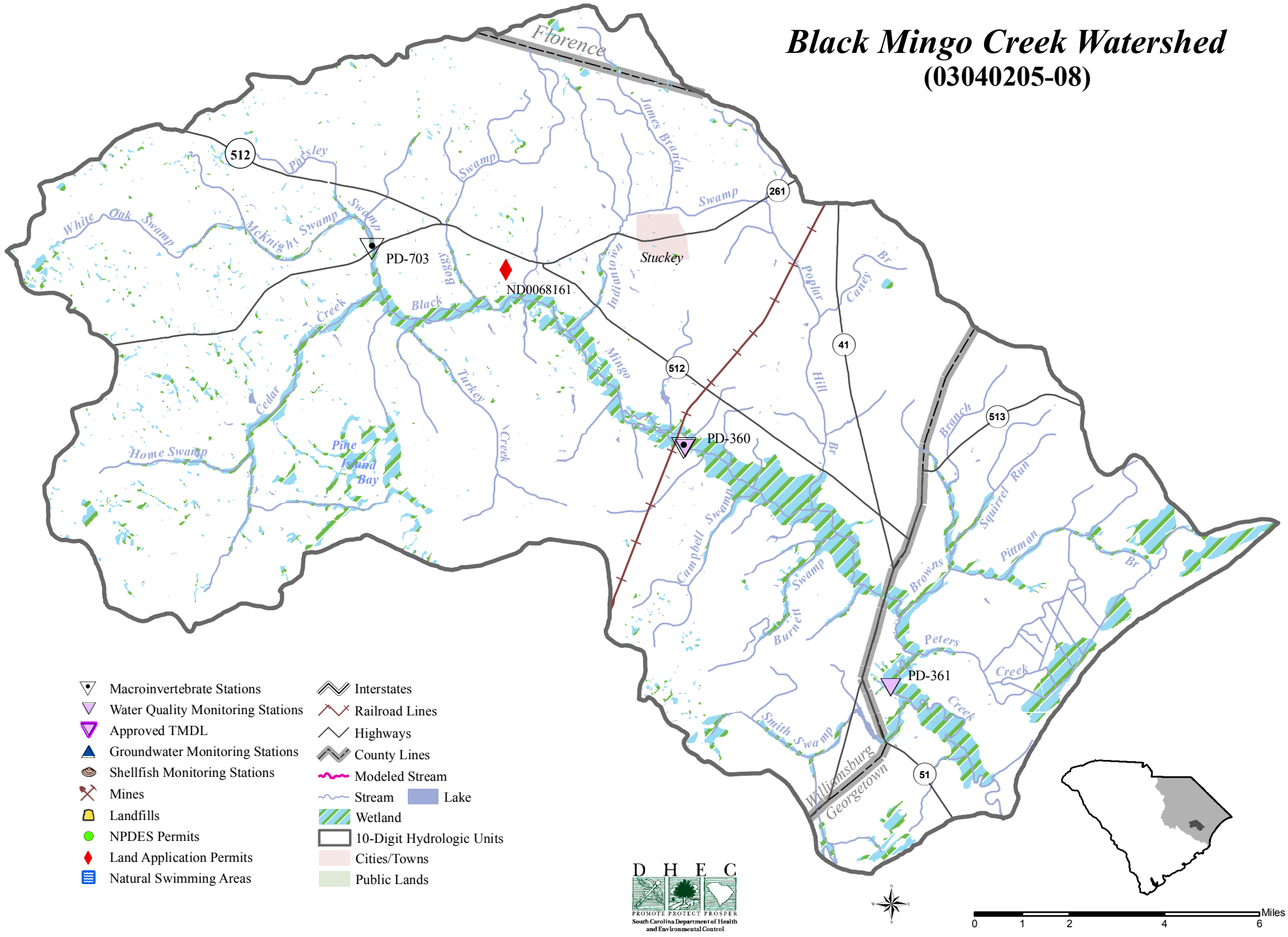

Great Pee Dee River / Winyah Bay Watershed
(03040207-02)
0899-67
SCG730538
1552-67
1682-67
1776-67
SCG730043
1704-67
1765-67
Johnsonville
SC0039934
Florence
451003-3001
41
Hemingway
AMB-050
Hemingway
Marion
Williamsburg
Georgetown
SC0039195
SC0039101
PD-060
PD-061
Horry
261
701
SCG645051
MD-275
MD-080
RO-02012
Georgetown
222678-3001
AMB-012
Airport LF
RO-01121
RO-01161
1675-67
RO-01108
RO-02010
RS-03331
MD-278
05-05
05-02
05-06
05-01
05-20
05-07
05-21
05-25
05-24
Winyah Bay
Macroinvertebrate Stations
Water Quality Monitoring Stations
Approved TMDL
Groundwater Monitoring Stations
Shellfish Monitoring Stations
Mines
Landfills
NPDES Permits
Land Application Permits
Natural Swimming Areas
Interstates
Railroad Lines
Highways
County Lines
Modeled Stream
Stream
Lake
Bay/Estuary
Wetland
10-Digit Hydrologic Units
Cities/Towns
Public Lands
0 1 2 4 6 8 10
Miles
D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control


Pudding Swamp Watershed
(03040205-05)
211003-1701
SC0038962
AMB-009
Olanta
RS-01002
PD-695
ND0085014
PD-157
SCG730691
SCG730201
PD-203
WOODS BAY STATE PARK
Turbeville
Lee
Sumter
Clarendon
Florence
Williamsburg
Three mile Branch
Pudding Swamp
Hope Swamp
Swamp
Douglas Br
Cypress Br
Bushy Br
Burnt Br
Horse Cypress Lake
Rose Ck
Newman Swamp
Cain Br
Branch
76
58
53
341
95
301
378
Macroinvertebrate Stations
Water Quality Monitoring Stations
Approved TMDL
Groundwater Monitoring Stations
Shellfish Monitoring Stations
Mines
Landfills
NPDES Permits
Land Application Permits
Natural Swimming Areas
Interstates
Railroad Lines
Highways
County Lines
Modeled Stream
Stream
Lake
Wetland
10-Digit Hydrologic Units
Cities/Towns
Public Lands
Miles
0
1
2
4
D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

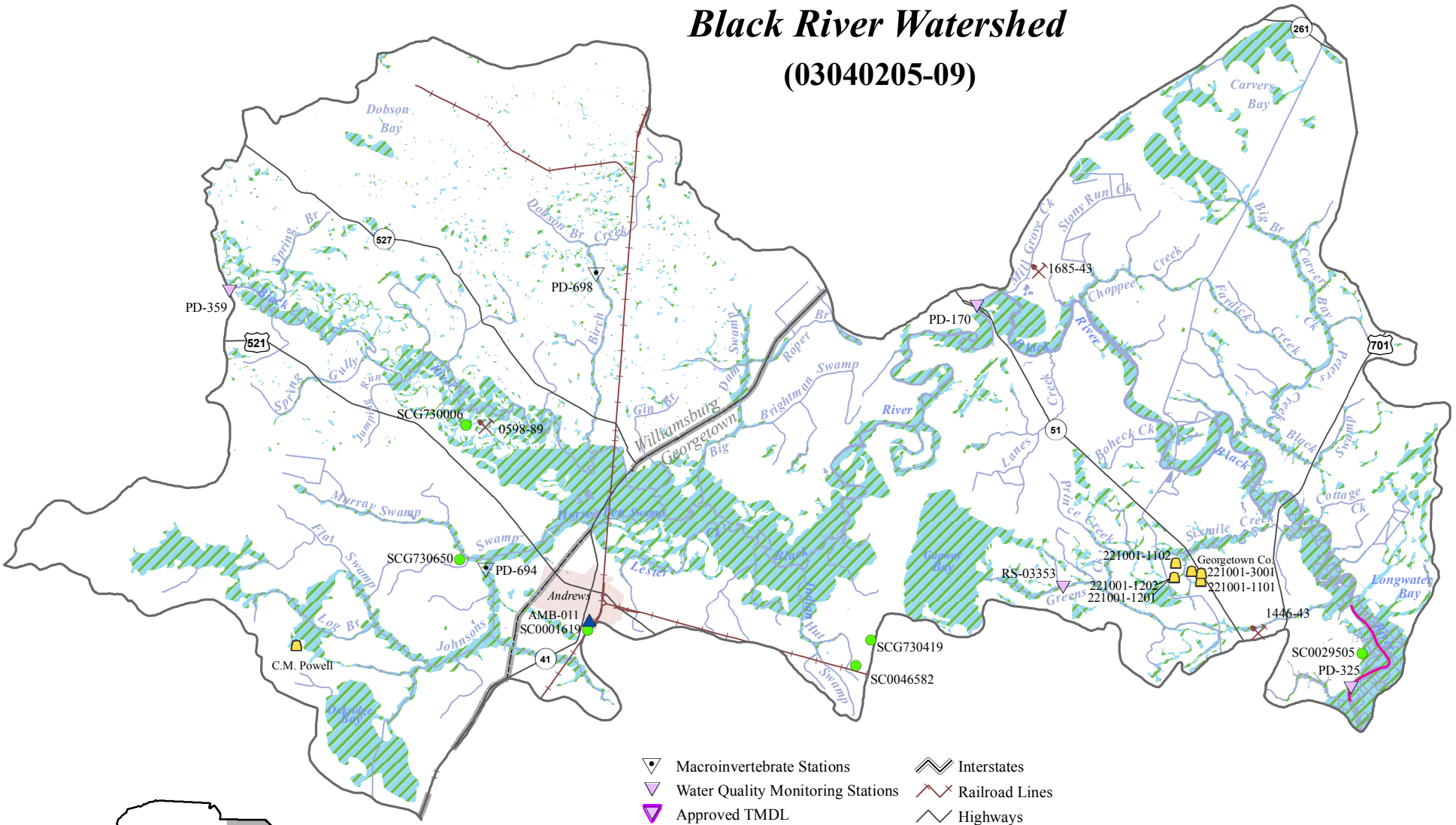

Black River Watersheds
(03040205-02, -06)
02
06
Bishopville
Mayesville
312411-3001
312411-1101
PD-354
SCG730597
ND0069787
PD-353
RS-02477
PD-116
PD-227
SCG730684
Macroinvertebrate Stations
Water Quality Monitoring Stations
Approved TMDL
Groundwater Monitoring Stations
Shellfish Monitoring Stations
Mines
Landfills
NPDES Permits
Land Application Permits
Natural Swimming Areas
Interstates
Railroad Lines
Highways
County Lines
Modeled Stream
Stream
Lake
Wetland
10-Digit Hydrologic Units
Cities/Towns
Public Lands
Miles
0 1 2 4 6 8 10 12
D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

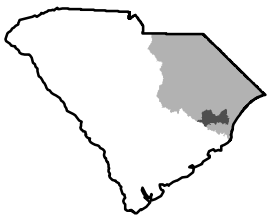

Black River Watershed
(03040205-07)
Macroinvertebrate Stations
Water Quality Monitoring Stations
Approved TMDL
Groundwater Monitoring Stations
Shellfish Monitoring Stations
Mines
Landfills
NPDES Permits
Land Application Permits
Natural Swimming Areas
Interstates
Railroad Lines
Highways
County Lines
Modeled Stream
Stream
Lake
Wetland
10-Digit Hydrologic Units
Cities/Towns
Public Lands
Florence
Clarendon
Williamsburg
Kingstree
Greeleyville
Lane
Smiths Bay
Long Bull Br
Swamp
Clapp Br
Canal
Black River
Bennett Swamp
Mill Br
Dickey Swp
Laws Swamp
Boggy Swamp
Thornwee River
Stony Run Branch
McElhoy Br
Ox Swamp
PD-696
RS-02325
452699-3001
1153-89
0838-89
SCG730220
SCG730712
453305-1601
SC0003123
452767-8001
Williamsburg Co.
PD-358
453349-1601
Dump #1
Dump #2
PD-044
Gauze Troy
AMB-020
SC0035971
SC0023493
PD-697
1603-89
PD-206
Williamsburg Cnty
451001-1101
451001-1201
402769-4001
1342-89
PD-045
PD-629
378
261
52
377
521
0 1 2 4 6 8 Miles
D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control


Lynches River and Lake Swamp Watersheds
(03040202-06, -07)
Macroinvertebrate Stations
Water Quality Monitoring Stations
Approved TMDL
Groundwater Monitoring Stations
Shellfish Monitoring Stations
Mines
Landfills
NPDES Permits
Land Application Permits
Natural Swimming Areas
Interstates
Railroad Lines
Highways
County Lines
Modeled Stream
Stream
Lake
Wetland
10-Digit Hydrologic Units
Cities/Towns
Public Lands
07
06
PD-041
SC0039284
Florence Co.
Lynches River State Park
PD-168
AMB-010
Pamplico
PD-631
1202-41
1343-41
SCG730613
SCG730365
Scranton
Coward
PD-085
PD-346
Lake City
SC0046311
PD-169
PD-281
0648-41
SC0025933
Wellman Ind.
Johnsonville
PD-086A
RS-02318
Lake City Proposed C&D LF
City of Lake City
SCG250092
451002-1201
PD-314
PD-087
AMB-007
Florence
Williamsburg
Twomile Branch
Cypress Branch
Camp Branch
Smith Swamp
Long Br
Singleton Swamp
McNamee Swamp
Millpond Branch
High Hill Drainage Canal
Gum Br
Big Swamp Br
Buck Br
Cypress Br
Big Cypress Swamp
Little Swamp
Deep Creek
Lynches River
Lake Swamp
Lake Swamp
Mill Branch
Big Branch
McCall Br
Green Spring Br
Lynches Cr
301
327
52
541
403
341
51
378
41
512
Miles
0
1
2
4
6
8
DHEC
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control


Black Mingo Creek Watershed
(03040205-08)
Florence
512
261
41
513
51
PD-703
ND0068161
PD-360
PD-361
Stuckey
Williamsburg
Georgetown
Macroinvertebrate Stations
Water Quality Monitoring Stations
Approved TMDL
Groundwater Monitoring Stations
Shellfish Monitoring Stations
Mines
Landfills
NPDES Permits
Land Application Permits
Natural Swimming Areas
Interstates
Railroad Lines
Highways
County Lines
Modeled Stream
Stream
Lake
Wetland
10-Digit Hydrologic Units
Cities/Towns
Public Lands
D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control
0 1 2 4 6
Miles

Black River Watershed
(03040205-09)





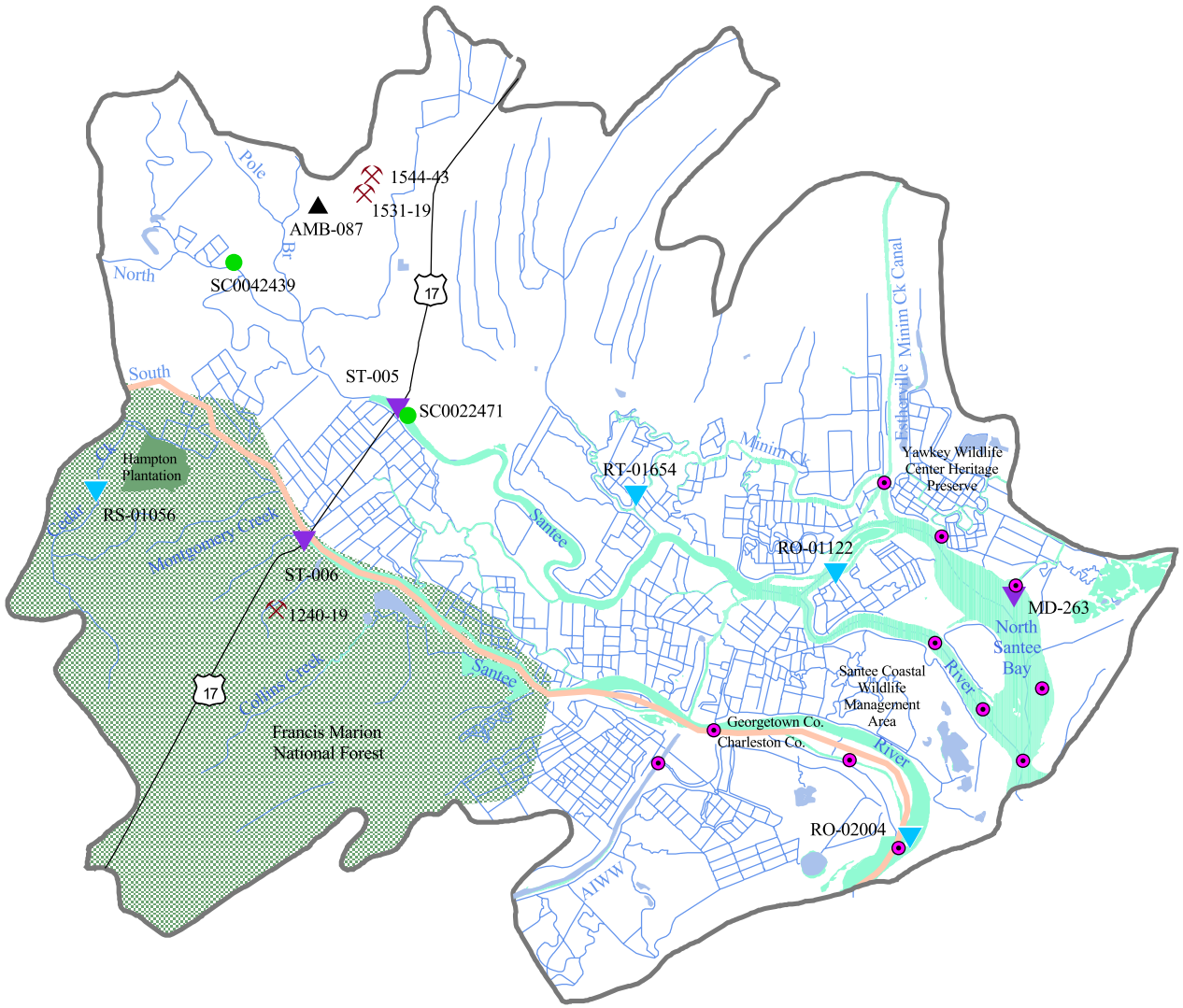
Macroinvertebrate Stations
Water Quality Monitoring Stations
Approved TMDL
Groundwater Monitoring Stations
Shellfish Monitoring Stations
Mines
Landfills
NPDES Permits
Land Application Permits
Natural Swimming Areas

Interstates
Railroad Lines
Highways
County Lines
Modeled Stream
Stream
Lake
Wetland
10-Digit Hydrologic Units
Cities/Towns
Public Lands

0 1 2 4 6 8 Miles

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

North and South Santee Rivers Watersheds
(03050112-060)



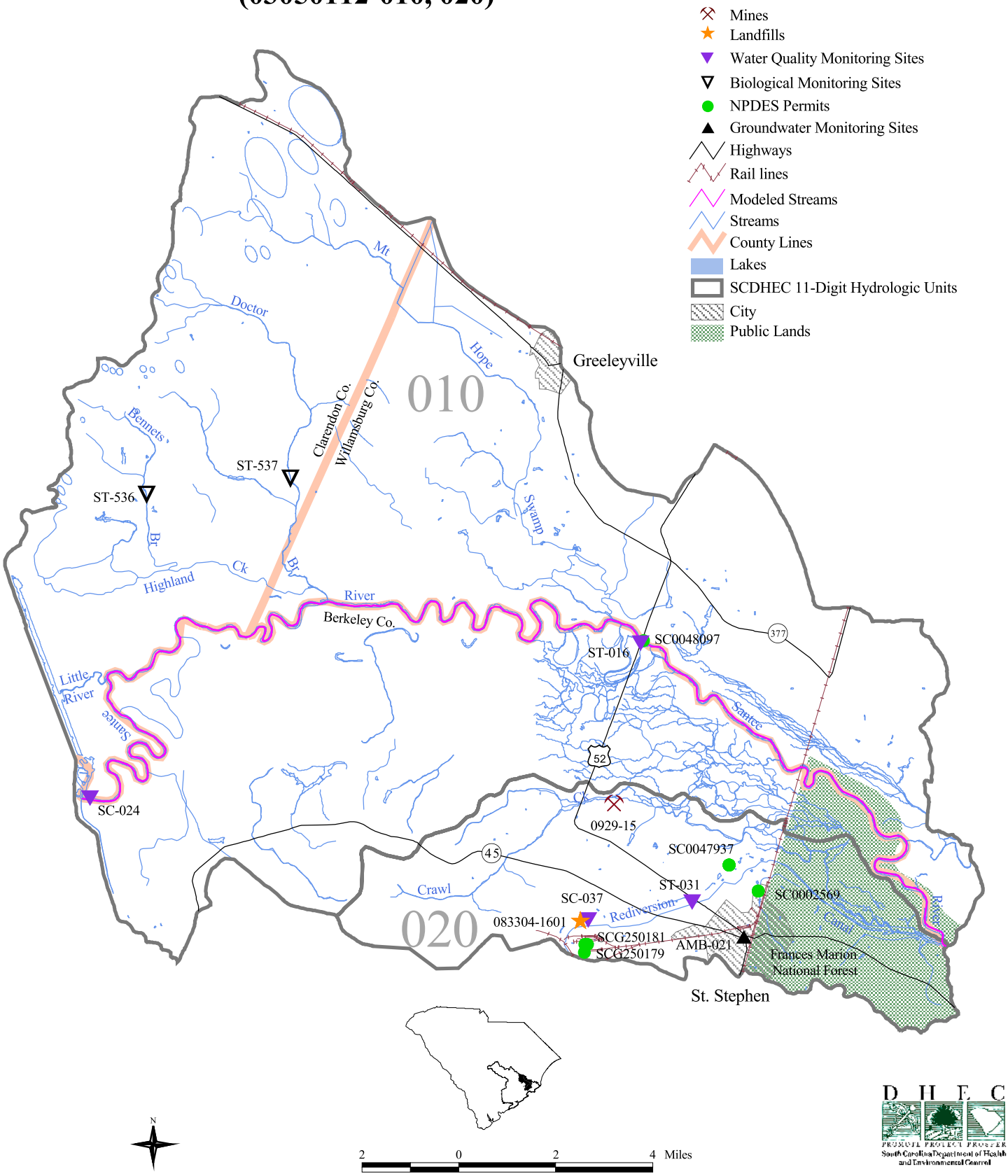
- NPDES Permits
- Mines
- Water Quality Monitoring Sites
- Groundwater Monitoring Sites
- Random Sites - 2001-2002
- Shellfish Monitoring Sites
- Highways
- Streams
- County Lines
- Lakes
- Estuaries
- 11-Digit Hydrologic Units
- City
- Public Lands

D H E C
South Carolina Department of Health and Environmental Control

2 0 2 4 Miles

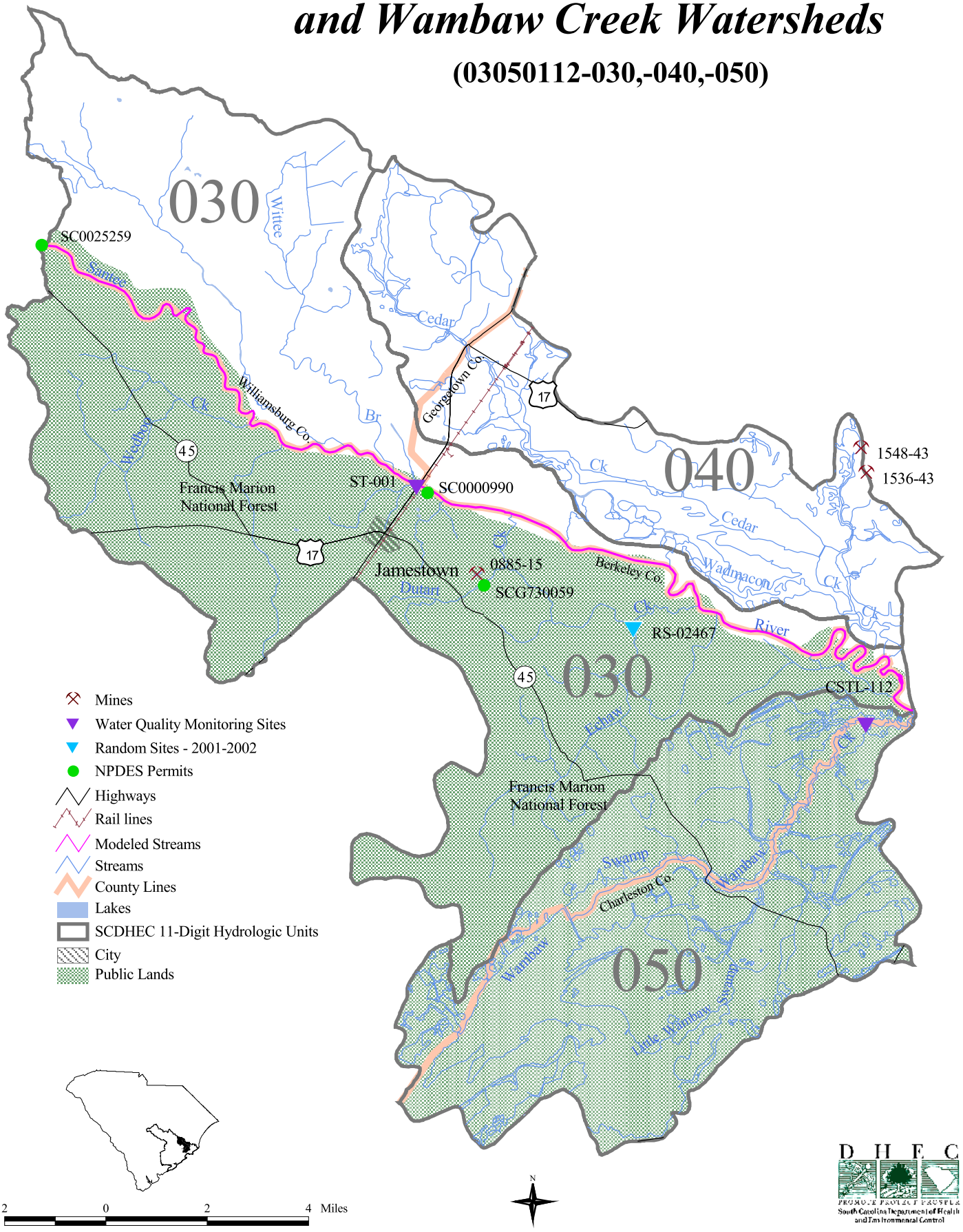
Santee River and Rediversion Canal Watersheds

(03050112-010, 020)



Santee River, Wadmacon Creek, and Wambaw Creek Watersheds

(03050112-030,-040,-050)



American Rivers. *Waccamaw River Blue Trail*. Retrieved July 2010 from http://www.americanrivers.org/our-work/protecting-rivers/blue-trails/waccamaw.html

American Society of Civil Engineers. *International Stormwater Best Management Practice Database.* Retrieved February 2011 from http://www.bmpdatabase.org/

Arbor Day Foundation. *Tree City USA.* Retrieved June 2010 from http://www.arborday.org/programs/treeCityUSA/index.cfm

Audubon International. *Audubon Cooperative Sanctuary Program for Golf Courses* Retrieved April 2011 from http://acspgolf.audubonintemational.org/

City of Conway. *River Friendly Business Program.* Retrieved January 2011 from http://www.cityofconway.com/

Clemson University Cooperative Extension. *Confined Animal Manure Managers Program.* Retrieved February 2011 from http://www.clemson.edu/extension/

Clemson University, Public Service Activities. *Certified Erosion Prevention and Sediment Control Inspector Program.* Retrieved December 2010 from http://www.clemson.edu/public/cepsci/

Clemson University, Public Service Activities- Carolina Clear. *South Carolina Low Impact Development Atlas.* Retrieved December 2010 from http://www.clemson.edu/public/carolinaclear/

Coastal Biodiesel Group. *Green Grease Certification Program.* Retrieved February 2011 from http://www.coastalbiodiesel.com/

Coastal Carolina University, Waccamaw Watershed Academy. *Kingston Lake Environmental Awareness Network.* Retrieved January 2011 from http://www.coastal.edu/wwa/klean/

Coastal Carolina University, Waccamaw Watershed Academy. *Volunteer Water Monitoring Program* Retrieved December 2010 from http://www.coastal.edu/wwa/vm/index.html

Coastal Waccamaw Stormwater Education Consortium General information retrieved July 2010 from http://www.cwsec-sc.org/doku.php?id=index.php

Horry County, South Carolina. *The Horry County "Envision 2025" Comprehensive Plan.* Retrieved May 2010 from http://www.horrycounty.org/envision/default.asp

International Organization for Standardization. *14000 Family of Environmental Standards.* Retrieved March 2011 from http://www.iso.org/iso/iso_catalogue/management_and_leadership_standards/environmental_management.htm

National Geographic. *Center for Sustainable Destinations*. Retrieved March 2011 from http://travel.nationalgeographic.com/travel/sustainable/

Natural Resources Defense Council. *Testing the Waters: A Guide to Water Quality at Vacation Beaches.* Retrieved October 2010 from http://www.nrdc.org/water/oceans/ttw/titinx.asp

North Carolina State University/ North Carolina A&T University Cooperative Extension, Watershed Education for Communities and Officials. *Low Impact Development- An Economic Fact Sheet.* Retrieved March 2011 from http://www.ces.ncsu.edu/depts/agecon/WECO/index.html

North Inlet- Winyah Bay National Estuarine Research Reserve. *Coastal Training Program.* Retrieved August 2010 from http://www.northinlet.sc.edu/training/services.html

North Inlet- Winyah Bay National Estuarine Research Reserve *System Wide Monitoring Program* Retrieved December 2010 from *http://www.northinlet.sc.edu/research/swmp.html*

Population and Economy, Waccamaw Regional Planning and Development Council, 1972.

Soil Survey of Georgetown County, South Carolina. Soil Conservation Service, United States Department of Agriculture, 1982.

Soil Survey of Horry County, South Carolina. Soil Conservation Service, United States Department of Agriculture, 1986.

Soil Survey of Williamsburg County, South Carolina. Soil Conservation Service, United States Department of Agriculture, 1989.

South Carolina Budget and Control Board. *South Carolina Statistical Abstract.* Retrieved March and April 2010, from http://abstract.sc.gov/index.php

South Carolina Department of Health and Environmental Control. *2011 South Carolina Fish Consumption Advisories.* Retrieved March 2011 from http://www.scdhec.gov/environment/water/fish/index.htm

South Carolina Department of Health and Environmental Control. *Beach Monitoring* Retrieved December 2010 from http://www.scdhec.gov/environment/water/ow.htm

South Carolina Department of Health and Environmental Control. *NPDES General Permit for Discharges Associated with Nonmetal Mineral Mining Facilities.* Retrieved September 2010 from http://www.scdhec.gov/environment/water/

South Carolina Department of Health and Environmental Control. *NPDES General Permit for Discharges from the Application of Pesticides.* Retrieved April 2011 from http://www.scdhec.gov/environment/water/npdes_pesticide.htm

South Carolina Department of Health and Environmental Control. *NPDES General Permit for "No-Discharge" Concentrated Animal Feeding Operations (CAFOs)* Retrieved January 2011 from http://www.scdhec.gov/environment/water/agpage.htm

South Carolina Department of Health and Environmental Control. *NPDES General Permit for Storm Water Discharges Associated With Industrial Activities (Except Construction)* Retrieved January 2011 from http://www.scdhec.gov/environment/water/swnpdes.htm

South Carolina Department of Health and Environment Control. *Priority List of Environmentally Distressed Communities, 2010.*

South Carolina Department of Health and Environmental Control. *S.C. Regulation 61-56, Onsite Wastewater Systems.* Retrieved August 2010 from http://www.scdhec.gov/health/envhlth/septic/

South Carolina Department of Health and Environmental Control. *S.C. Regulation 61-68, Water Classifications and Standards* Retrieved December 2010 from *http://www.scdhec.gov/environment/water/*

South Carolina Department of Health and Environmental Control. *S.C. Regulation 61-69 Classified Waters* Retrieved December 2010 from *http://www.scdhec.gov/environment/water/*

South Carolina Department of Health and Environmental Control. *Shellfish Program.* Retrieved November 2010 from http://www.scdhec.gov/environment/water/shellfish.htm

South Carolina Department of Health and Environmental Control. *Sludge Program.* Retrieved January 2011 from http://www.scdhec.gov/environment/water/sludgepage.htm

South Carolina Department of Health and Environmental Control. *Source Water Protection Program* Retrieved February 2011 from http://www.scdhec.gov/environment/water/srcewtr.htm

South Carolina Department of Health and Environmental Control. *South Carolina Ambient Groundwater Quality Monitoring Network-2003 Annual Report.* Retrieved November 2010 from http://www.scdhec.gov/environment/water/ambient.htm

South Carolina Department of Health and Environmental Control. *South Carolina Groundwater Contaminant Inventory* Retrieved February 2011 from http://www.scdhec.gov/environment/water/gw.htm

South Carolina Department of Health and Environmental Control. *South Carolina Nonpoint Source Management Program 1999 Update.* Retrieved June 2010 from http://www.scdhec.gov/environment/water/

South Carolina Department of Health and Environmental Control. *South Carolina NPDES General Permit for Stormwater Discharges from Large and Small Construction Activities.* Retrieved December 2010 from http://www.scdhec.gov/environment/admin/htm/permtype.htm#Water

South Carolina Department of Health and Environmental Control. *State of South Carolina Monitoring Strategy, for Calendar Year 2010.* Retrieved February 2011 from http://www.scdhec.gov/environment/water/monitoring.htm

South Carolina Department of Health and Environmental Control. *State Revolving Fund.* Retrieved May 2010 from http://www.scdhec.gov/environment/water/srf.htm

South Carolina Department of Health and Environmental Control. *State of South Carolina NPDES General Permit for Storm Water Discharges from Regulated Small Municipal Separate Storm Sewer Systems (SMS4)* Retrieved January 2011 from http://www.scdhec.gov/environment/water/swnpdes.htm

South Carolina Department of Health and Environmental Control. *The State of South Carolina's 2010 Integrated Report.* Retrieved August 2010 from http://www.scdhec.gov/environment/water/tmdl/

South Carolina Department of Health and Environmental Control. *Total Maximum Daily Load Determination for the Waccamaw River and the Atlantic Intracoastal Water Way Near Myrtle Beach, SC.* Retrieved November 2010 from http://www.scdhec.gov/environment/water/tmdl/index.htm

South Carolina Department of Health and Environmental Control. *Total Maximum Daily Loads for Fecal Coliform in Shellfish Waters of the Litchfield-Pawley's Island Estuary, South Carolina.* Retrieved November 2010 from http://www.scdhec.gov/environment/water/tmdl/index.htm

South Carolina Department of Health and Environmental Control. *Total Maximum Daily Loads for Fecal Coliform for Pee Dee River Basin.* Retrieved November 2010 from http://www.scdhec.gov/environment/water/tmdl/index.htm

South Carolina Department of Health and Environmental Control. *Total Maximum Daily Loads for Fecal Coliform in Shellfish Waters of the Murrell's Inlet Estuary, South Carolina.* Retrieved November 2010 from http://www.scdhec.gov/environment/water/tmdl/index.htm

South Carolina Department of Health and Environmental Control. *Wastewater Overflows.* Retrieved November 2010 from http://www.scdhec.gov/environment/water/sso-psf_display.aspx

South Carolina Department of Health and Environmental Control, Ocean and Coastal Resources Management. *South Carolina Clean Marina Guidebook, 2010.* Retrieved March 2011 from http://www.scdhec.gov/environment/ocrm/clean_marina.htm

South Carolina Department of Natural Resources. *Heritage Trust Program.* Retrieved September 2010 from http://www.dnr.sc.gov/regs/heritageregs.html

South Carolina Department of Natural Resources. *Scenic Rivers Program.* Retrieved September 2010 from http://www.dnr.sc.gov/water/envaff/river/scenicrivers.html

South Carolina Department of Parks, Recreation, and Tourism. *Tourism Product Development Concept for the Pee Dee Region-Strategy and Plan.* Retrieved February 2011 from *http://www.scprt.com/tourism-business/tourism-development-plan.aspx*

South Carolina Department of Parks, Recreation, and Tourism. *Tourism Product Development Concept for the Waccamaw Grand Strand Region- Strategy and Plan.* Retrieved February 2011 from http://www.scprt.com/tourism-business/tourism-development-plan.aspx

South Carolina Department of Transportation. *State of South Carolina NPDES Permit for Storm Water Discharges from the Large Municipal Separate Storm Sewer System Owned and Operated by the South Carolina Department of Transportation.* Retrieved January 2011 from http://www.scdot.org/ms4/default.shtml

South Carolina Estuarine and Coastal Assessment Program. *Sediment Quality 2001-2002.* Retrieved March 2011 from http://www.dnr.sc.gov/marine/scecap/index.htm

South Carolina Forestry Commission. *Strategic Plan.* Retrieved June 2010 from http://www.state.sc.us/forest/

The Belle Baruch Foundation. *Hobcaw Barony.* Retrieved September 2010 from http://www.hobcawbarony.org/

The Economic Benefits of Protecting Virginia's Streams, Lakes, and Wetlands. The Center for Watershed Protection, 2001

The International Ecotourism Society. *Principles of Ecotourism.* Retrieved January 2011 from www.ecotourism.org

Tibbs, Hardin. *Industrial Ecology: An Environmental Agenda for Industry.* Retrieved March 2011 from http://www.hardintibbs.com

United Nations World Water Assessment Programme. *1992 Dublin Statement on Water.* Retrieved February 2011 from http://www.unesco.org/water/wwap/

United States Census Bureau. *Decennial Census 2000 Summary File 1.* Retrieved March and April 2010, from http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml

United States Census Bureau. *Decennial Census 2010 Demographic Profile 1.* Retrieved May 2011, from http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml

United States Department of Agriculture, Center for Forested Wetlands Research. *Santee Experimental Forest.* Retrieved January 2011 from http://www.srs.fs.usda.gov/charleston/santee/

United States Department of Agriculture, National Agricultural Statistics Service. *2007 Census of Agriculture.* Retrieved January 2011 from http://www.agcensus.usda.gov/

United States Department of Energy. *Energy Star Portfolio Manager.* Retrieved February 2011 from http://www.energystar.gov/index.cfm?c=home.index

United States Department of Energy. *Save Energy Now.* Retrieved November 2011 from http://www1.eere.energy.gov/industry/saveenergynow/

United States Environmental Protection Agency. *Environmental Technologies Opportunities Portal*. Retrieved March 2011 from http://www.epa.gov/etop/index.html

United States Environmental Protection Agency. *Environmental Technology Verification Program.* Retrieved March 2011 from http://www.epa.gov/etv/

United States Environmental Protection Agency. *Federal Water Pollution Control Act.* Retrieved May 2010 from http://www.epa.gov/lawsregs/laws/cwa.html

United States Environmental Protection Agency. *Industrial Stormwater Fact Sheet Series.* Retrieved April 2011 from http://cfpub.epa.gov/npdes/stormwater/swsectors.cfm

United States Environmental Protection Agency. *Introduction to the National Pretreatment Program,* June 2011. Retrieved June 2011 from http://cfpub.epa.gov/npdes/home.cfm?program_id=3

United States Environmental Protection Agency. *National Menu of Stormwater Best Management Practices.* Retrieved January 2011 from http://cfpub.epa.gov/npdes/stormwater/menuofbmps/

United States Environmental Protection Agency. *National Water Quality Inventory: Report to Congress.* Retrieved June 2010 from http://water.epa.gov/lawsregs/guidance/cwa/305b/

United States Environmental Protection Agency. *Permit Compliance System.* Retrieved May 2010 from *http://www.epa.gov/enviro/facts/pcs/index.html*

United States Environmental Protection Agency. *Sanitary Sewer Overflow Analysis a Planning Toolbox (SSOAP)* Retrieved January 2011 from http://www.epa.gov/nrmrl/wswrd/wq/models/ssoap/

United States Environmental Protection Agency. *Sustainable Infrastructure Initiative.* Retrieved February 2011 from http://water.epa.gov/infrastructure/sustain/

United States Environmental Protection Agency. *Water Quality Scorecard: Incorporating Green Infrastructure Practices at the Municipal, Neighborhood, and Site Scale.* Retrieved May 2010 from http://www.epa.gov/smartgrowth/index.htm

United States Environmental Protection Agency. *WaterSense Program.* Retrieved September 2010 from http://www.epa.gov/WaterSense/

United States Fish and Wildlife Service. *Waccamaw National Wildlife Refuge.* Retrieved August 2010 from http://www.fws.gov/waccamaw/

United States Geological Survey. Columbia Environmental Research Center. *Publication Brief: "Widespread Occurrence of Intersex Bass Found in US Rivers".* Retrieved October 2010 from http://www.cerc.usgs.gov/Content/UploadedFiles/ExternalDocs/bass_intersex-09-rev.pdf

United States Geological Survey. *National Water Information System*. Retrieved May 2010 from http://waterdata.usgs.gov/nwis

United States Geological Survey. *Toxic Substances Hydrology Program.* Retrieved May 2011 from http://toxics.usgs.gov/

United States Geological Survey. *Water Use in South Carolina, 2005* Retrieved March 2011 from *http://sc.water.usgs.gov/infodata/wateruse.html*

Waccamaw 208 Areawide Water Quality Management Plan Update, Waccamaw Regional Council of Governments, 1998.

Water Environment Federation. *National Biosolids Partnership.* Retrieved November 2010 from http://www.wef.org/biosolids/

Watershed Water Quality Assessment- Pee Dee River Basin. South Carolina Department of Health and Environmental Control, 2007.

Watershed Water Quality Assessment- Santee River Basin. South Carolina Department of Health and Environmental Control, 2005.

Winyah Rivers Foundation. *Waccamaw Riverkeeper Program.* Retrieved July 2010 from http://www.winyahrivers.org/

World Environment Federation. *World Water Monitoring Day.* Retrieved November 2010 from *http://www.worldwatermonitoringday.org/*

Yadkin Pee-Dee River Basin Plan. US Water Resources Council, 1981

This Page Has Been Left Blank Intentionally